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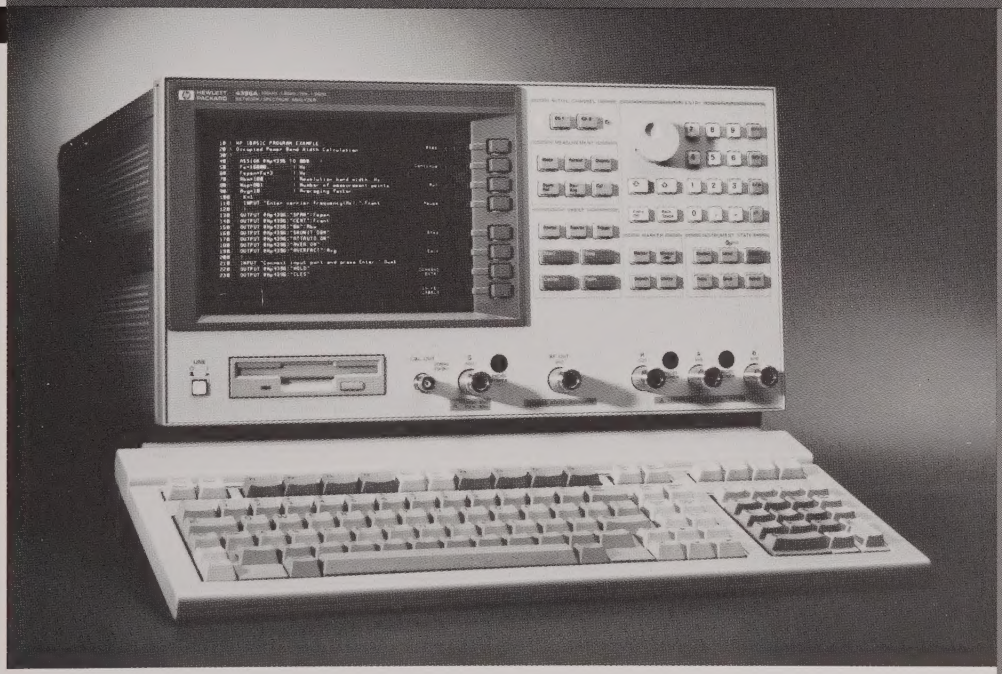


HP 4396A
Network/Spectrum Analyzer

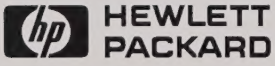
Using HP Instrument BASIC with the HP 4396A

HP 4396A Network/Spectrum Analyzer

Using HP Instrument BASIC with the HP 4396A

SERIAL NUMBERS

This manual applies directly to instruments with serial number prefix 3343J and above, or whose firmware is version 2.0 and later. For additional important information about serial numbers, read "Instruments Covered by This Manual" in Appendix A.



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Yokogawa-Hewlett-Packard, LTD.
Kobe Instrument Division
1-3-2, Murotani, Nishi-ku, Kobe-shi,
Hyogo, 651-22 Japan

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March 1993 ..... Second Edition

April 1994 ..... Third Edition

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.
The Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

Ground The Instrument

This is a Safety Class 1 product (provided with a protective earth terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure the safety features are maintained.

Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Warning

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

Typeface Conventions

Bold	Boldface type is used when a term is defined. For example: **icons** are symbols.
Italics	Italic type is used for emphasis and for titles of manuals and other publications. Italic type is also used for keyboard entries when a name or a variable must be typed in place of the words in italics. For example: `copy` *filename* means to type the word `copy`, to type a space, and then to type the name of a file such as `file1`.
`Computer`	Computer font is used for on-screen prompts and messages.
HARDKEYS	Labeled keys on the instrument front panel are enclosed in ▢.
SOFTKEYS	Softkeys located to the right of the CRT are enclosed in .

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *Specifications* of *Function Reference*, the warranty shall be for the specified period. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instruction when property installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation Of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. HP specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. HP shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

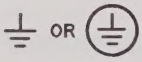
For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

Safety Symbols

General definitions of safety symbols used on equipment or in manuals.

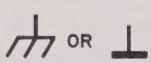
Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with wiring terminals to indicate the terminal which must be connected to ground before operating equipment.

Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (Operation) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

Warning

Warning denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

Caution

Caution sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result damage to or destruction of part or all of the product.

Note

Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

How to Use This Manual

This guide will help you learn how to effectively use HP Instrument BASIC (IBASIC) of the HP 4396A Network/Spectrum Analyzer. It will help you to perform typical operations involving program creation, editing, and execution. It will also show you how to save and recall programs, and how to make the best use of the HP Instrument BASIC's front-panel and keyboard interface. Here is a brief guide to help you locate the necessary information in this manual.

- Chapter 2 introduces the analyzer's HP Instrument BASIC system and describes how to connect and use a keyboard.
- Chapter 3 and Chapter 4 show creating, getting, and saving programs to teach you front panel and keyboard operation.
- Chapter 5 introduces you to the editing environment.
- Chapter 6 provides application programs and useful techniques for developing programs.
- Chapter 7 describes interfacing features for graphics, external connector to trigger RUN/CONTinue of a program, and I/O port.
- Chapter 8 introduces special features for auto loading a program, and the On Key Label function (softkeys defined in a program). This chapter also describes techniques for speeding up your programs.
- Chapter 9 summarizes the unique features specified for the analyzer.
- Appendix A contains the information required to adept this manual to earlier versions or configurations of the analyzer than the current printing date of this manual.
- Appendix B provides references for BASIC commands specific to the analyzer's HP Instrument BASIC.
- Appendix C provides a handy reference guide to the analyzer's HP Instrument BASIC's key definitions for the HP-HIL keyboard.
- Appendix D describes the softkeys that are used for the HP Instrument BASIC operations.

Documentation Map

The following manuals are available for the analyzer.

User's Guide (HP Part Number 04396-90001)

The User's Guide walks you through system setup and initial power-on, shows you how to make basic measurements, explains commonly used features, and contains typical application measurement examples. After you receive your analyzer, begin with this manual.

The Task Reference (HP Part Number 04396-90000)

The Task Reference helps you to learn how to use the analyzer. This manual provides simple step-by-step instructions without concepts.

Function Reference (HP Part Number 04396-90002)

The Function Reference describes all functions accessed from the front panel keys and softkeys. It also provides information on options and accessories available, specifications, system performance, and conceptual information about the analyzer's features.

HP-IB Programming Guide (HP Part Number 04396-90003)

The HP-IB Programming Guide shows how to write and use BASIC programs to control the analyzer.

HP-IB Command Reference (HP Part Number 04396-90004)

The HP-IB Command Reference provides a summary of all available HP-IB commands. It also provides information on the status reporting structure and the trigger system (these features conform to the SCPI standard).

Using HP Instrument BASIC with the HP 4396A (Option 1C2 only), (HP Part Number 04396-90005)

The Using HP Instrument BASIC with the HP 4396A describes how HP Instrument BASIC works with the analyzer.

HP Instrument BASIC Users Handbook (Option 1C2 only), (HP Part Number E2083-90000)

The HP Instrument BASIC Users Handbook introduces you to the HP Instrument BASIC programming language, provide some helpful hints on getting the most use from it, and provide a general programming reference. It is divided into three books, *HP Instrument BASIC Programming Techniques* , *HP Instrument BASIC Interface Techniques* , and *HP instrument BASIC Language Reference.*

Performance Test Manual (HP Part Number 04396-90100)

The Performance Test Manual provides the tests required to verify that the analyzer conforms to its published specifications.

Service Manual (Option 0BW only), (HP Part Number 04396-90101)

The Service Manual explains how to adjust, troubleshoot, and repair the analyzer.

Microfiche Copies of the Manual

Use the microfiche part number on the title page to order a package of 10 × 15 centimeter (4 × 6 inch) microfilm transparencies of the *User's Guide*, the *Task Reference*, the *Function Reference*, the *HP-IB Programming Guide*, the *HP-IB Command Reference*, the *Using HP Instrument BASIC with the HP 4396A*, the *Performance Test Manual*, and the *Service Manual*.

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1

Welcome to HP Instrument BASIC

This guide will help you learn how to effectively use HP Instrument BASIC (IBASIC) of the HP 4396A Network/Spectrum Analyzer. It will help you to perform typical operations involving program creation, editing, and execution. It will also show you how to save and recall programs, and how to make the best use of the HP Instrument BASIC's front-panel and keyboard interface.

If you are new to programming or to HP's dialect of BASIC, take the time to read this guide and perform the exercises. For many users, this will provide all the information that is needed to create and run programs.

How to Use This Manual

The tasks in each chapter, when performed in sequential order, demonstrate a typical use of HP Instrument BASIC and cover the most common tasks. Read the overview and try the sample tasks in each chapter to get you started. For more background information, you can read further into each chapter; otherwise, go to the next exercises and continue the session. You can refer back to the individual chapters for more information as necessary. Here is a brief guide to help you locate the necessary information in this manual and the other HP Instrument BASIC manuals.

- Chapter 2 introduces the analyzer's HP Instrument BASIC system and describes how to connect and use a keyboard.
- Chapter 3 and Chapter 4 show creating, getting, and saving programs to teach you front panel and keyboard operation.
- Chapter 5 introduces you to the editing environment.
- Chapter 6 provides application programs and useful techniques for developing programs.
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- Appendix C provides a handy reference guide to the analyzer's HP Instrument BASIC's key definitions for the HP-HIL keyboard.
- Appendix D describes the softkeys that are used for the HP Instrument BASIC operations.

Note

You should become familiar with the operation of the analyzer before attempting to control it using HP Instrument BASIC. See the following documents that are better suited to this task.

User's Guide
Task Reference
Function Reference
HP-IB Programming Guide
HP-IB Command Reference

About the HP Instrument BASIC Option of the Analyzer

The HP Instrument BASIC Option (HP 4396A Option 1C2) contains the followings:

- Keyboard Template (08751-87111)
- HP-HIL Keyboard
- Keyboard Cable
- *Using HP Instrument BASIC with the HP 4396A* (This book)
- *HP Instrument BASIC Users Handbook*
  (This handbook describes the HP Instrument BASIC programming language including keyword descriptions, error messages, interface specifics, and programming techniques. This handbook assumes that you have read the *Using HP Instrument BASIC with the HP 4396A.)*

Note

This manual assumes that you are using the HP-HIL keyboard.

Note

This manual, *Using HP Instrument BASIC with the HP 4396A* , is not intended to teach the HP Instrument BASIC programming language; see the following document which is better suited to these tasks.

HP Instrument BASIC Users Handbook

The handbook consists of the following three parts:

HP Instrument BASIC Programming Techniques
HP Instrument BASIC Interfacing Techniques
HP Instrument BASIC Language Reference

IF you want to port HP 9000 Series 200/300 BASIC programs to HP Instrument BASIC, see Chapter 10, "Keyword Guide to Porting," in the *HP Instrument BASIC Programming Techniques.*

2

Introduction to the System

This chapter introduces the analyzer's HP Instrument BASIC (IBASIC) and describes how to connect and use a keyboard. Read this chapter before using HP Instrument BASIC with the analyzer for the first time. The topics covered in this chapter are:

- Overview of HP Instrument BASIC
- Connecting the keyboard
- Using HP Instrument BASIC for the first time
- Using the keyboard
- Entering BASIC Statements from the front panel keys

Overview of HP Instrument BASIC

When installed in your analyzer, HP Instrument BASIC (IBASIC) can be used for a wide range of applications from simple recording and playback of measurement sequences to remote control of other instruments.

HP Instrument BASIC is a complete system controller residing inside your analyzer. It communicates with your analyzer via HP-IB commands and can also communicate with other instruments, computers, and peripherals over the HP-IB interface.

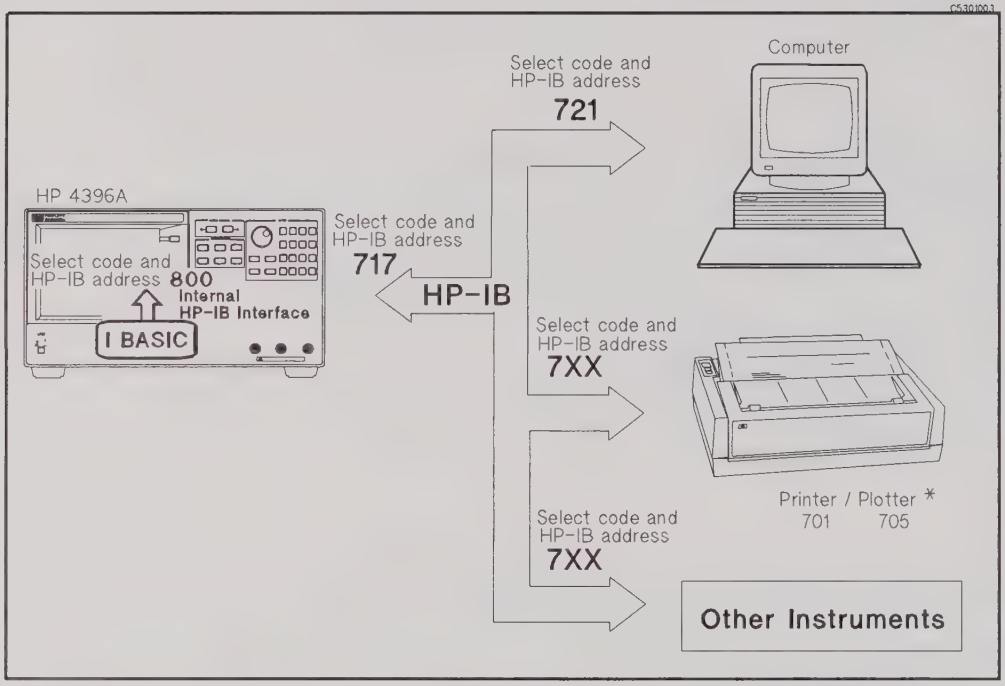


Figure 2-1. Configuration Example of the HP Instrument BASIC System

The HP Instrument BASIC's programming interface includes an editor and a set of programming utilities. The utilities allow you to perform disk I/O, renumber, secure, or delete all or part of your program.

The HP Instrument BASIC command set is similar to the command set of HP 9000 Series 200/300 BASIC. Therefore, HP Instrument BASIC programs can be run on any HP BASIC workstation with few if any changes. Porting information can be found in the *HP Instrument BASIC Programming Techniques* of the *HP Instrument BASIC Users Handbook.*

Connecting the Keyboard

Caution The keyboard cable plugs and sockets are not alike. If you force a plug into the wrong socket on the analyzer or keyboard, you can damage the equipment. Carefully follow installation instructions.

Note Turn OFF the analyzer before inserting or removing the keyboard connector.

When you use HP Instrument BASIC, connect the furnished keyboard to the HP-HIL connector on the rear panel.

1. Install the one-dot end of the keyboard cable into the one-dot socket on the keyboard.

2. Install the two-dot end of the cable into the two-dot socket labeled "HP-HIL" on the rear panel of the analyzer.

Using HP Instrument BASIC for the First Time

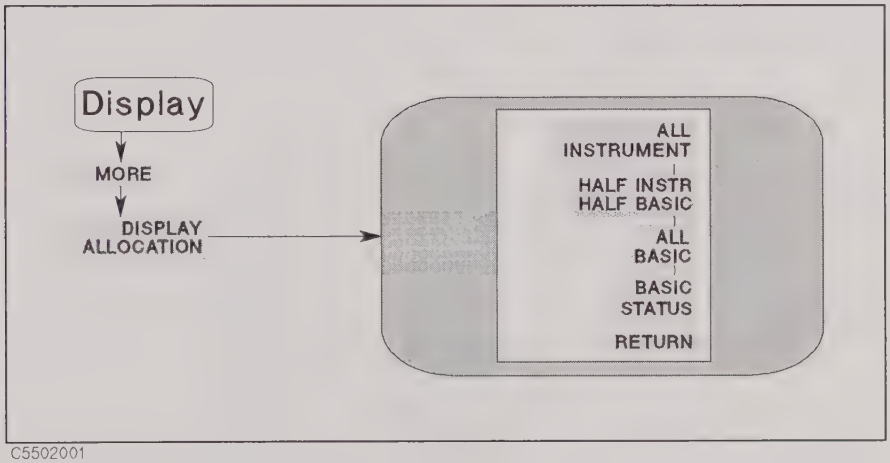
Allocating Screen Area for HP Instrument BASIC

Because all of the analyzer's screen is allocated for analyzer operation after power ON, you must allocate screen area for HP Instrument BASIC when you want to use it. The analyzer provides four display allocation types. Select one of them using `DISPLAY ALLOCATION` under (Display).

Let's try

1. Press the following key and softkeys:

   (Display) `MORE DISPLAY ALLOCATION`



2. Press the following softkey.

   `ALL BASIC`

   The screen is cleared and all of the screen area is allocated for HP Instrument BASIC.

3. Press the following softkey.

   `ALL INSTRUMENT`

   The total screen area is reallocated as the analyzer display.

4. Press the following softkey:

   `HALF INSTR HALF BASIC`

   The screen area is allocated so that the upper half of the screen is used for the analyzer operation and the lower half is used for HP Instrument BASIC.

5. Press the following softkey:

   BASIC STATUS

   Three blank lines appear at the display line (lower area of the screen). This area is used by HP Instrument BASIC to input commands and to display messages.

More information on the display allocations for the HP Instrument BASIC area is described in "(Display)" in Appendix D.

Setting the Size of Memory Area for HP Instrument BASIC

The size of the memory areas for the RAM disk memory and the variable of HP Instrument BASIC (excluding common variables) can be changed according to your application.

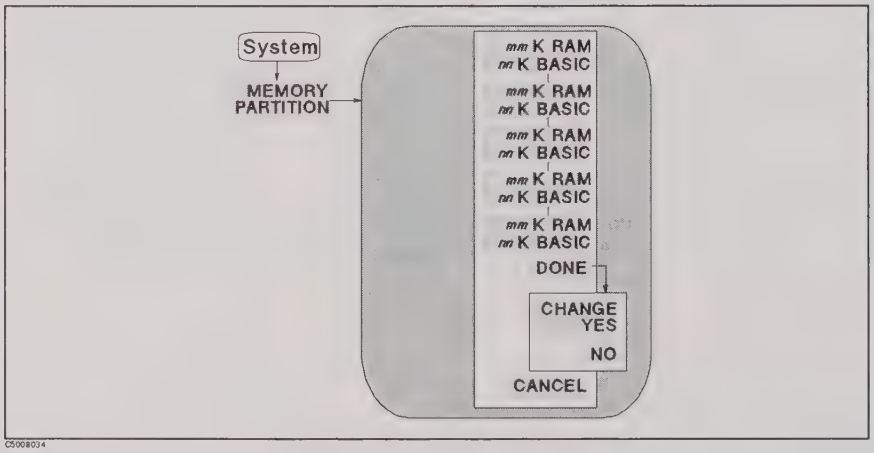
Caution

When the memory partition is reconfigured, the analyzer goes to the initial settings. That is, the RAM disk memory is initialized and all the data saved in the RAM disk memory is destroyed, and the program on the BASIC editor is destroyed.

Let's try

1. Press the following key and softkey.

   (System) MEMORY PARTITION



2. Press the desired softkey and DONE .

3. CHANGE YES and NO softkey labels are displayed.

   Press CHANGE YES to change the memory partition.

   Press NO to cancel changing the memory partition.

Using the Keyboard

What can the Keyboard be Used for?

The HP-HIL keyboard can be used as follows:

- Performing calculations
- Entering arguments to the active analyzer functions
- Entering titles
- Executing commands
- Using softkeys

The following simple operations show you how to use these functions.

Performing Calculations

You can perform calculations while in any display allocation type except for ALL INSTRUMENT.

Let's try

1. Press the following key and softkeys:

   (Display) MORE DISPLAY ALLOCATION ALL BASIC

   The screen is cleared and a cursor appears at the bottom left of screen.

2. Enter the following:

   3*2 (Return)

   The characters you enter are displayed at the current cursor position. After pressing (Return), the system responds with the following answer at the bottom of screen:

   6

For more information, see "Numeric Computation" in the *HP Instrument BASIC Programming Techniques* of the *HP Instrument BASIC Users Handbook.*

Entering Arguments to the Active Analyzer Functions

The numeric keys on the keyboard can be used to input the arguments for an active analyzer function the same as using the front panel keys.

Let's try

1. Press the following key and softkeys:

   (Display) MORE DISPLAY ALLOCATION ALL INSTRUMENT

2. Then press the following key:

   (Start)

   The current start frequency is displayed on the screen and becomes the active analyzer function.

3. Type a value to change the frequency from the keyboard. For example, type this:

   100000

   The START value is cleared and the value you typed is displayed.

4. Then press the following key on the keyboard:

   (Return)

   The START value is changed to 100 kHz.

5. Next, type the following value and key:

   2E6 (Return)

   After pressing (Return) the active function value is changed to 2 MHz. You can use the character "E" and "e" in an exponential expression.

Pressing (Back Space) on the keyboard deletes the last entry. This performs the same function as pressing (Back Space) on the front panel.

Entering Titles

The character entry keys can be used to enter a title on the screen instead of using front panel operation.

Let's Try

1. Press the following key and softkey:

   (Display) MORE TITLE

   A cursor appears at the top left of the graticule.

2. Type in characters using the keyboard, the characters you type appear at the top of the graticule.

3. Press the following key to terminate entry:

   (Return)

You can enter standard uppercase and lowercase letters for the title, using the (Shift) key to access the alternate case as usual. For more information on the character entry keys, see "Character Entry Keys" in Appendix C.

Executing Commands

You can type in and execute commands from the keyboard at all times except when:

- The display allocation is ALL INSTRUMENT.
- A command is being executed.
- The analyzer is in the EDIT mode.

At all other times, you can type in commands and press (Return) to present them to the system for execution. The system parses the command and takes the appropriate action.

Let's Try

1. Press the following key and softkey:

   (Display) MORE DISPLAY ALLOCATION HALF INSTR HALF BASIC

2. To check the current mass storage, type the following command:

   ```
   SYSTEM$("MSI") (Return)
   ```

3. The system returns:

   ```
   :,4
   ```

Using Softkeys

Pressing f1 through f8 on the keyboard performs the same function as pressing a softkey on the front panel.

Entering BASIC Statements from the Front Panel Keys

The analyzer's HP Instrument BASIC allows you to enter and execute statements from the front panel keys (if the external HP-HIL keyboard is not connected).

Press the following key and softkeys from the front panel:

System IBASIC COMMAND ENTRY

The Command Entry menu is displayed on the softkey menu area, and the active entry area displays the letters, the digits 0 through 9, and some special characters including mathematical symbols. Three sets of letters can be scrolled using the step keys, ⇧ and ⇩. To enter a statement, press the step keys for the desired letter set, rotate the knob until the arrow "↑" points at the first letter, then press SELECT LETTER. Repeat this until the complete statement is entered, then press DONE to execute the statement.

3

Writing and Running Programs

This chapter describes how to write, execute (run), and list programs. The example program in this chapter also describes how to control the analyzer from an HP Instrument BASIC program. Topics covered in this chapter are:

- Getting into/out of the EDIT mode
- Writing programs
- Running (Executing) programs
- Listing programs

Getting into/out of the EDIT Mode

When you write a program, you must be in the EDIT mode. For more information about the EDIT mode, see Chapter 5.

Getting into the EDIT Mode

Press the following key and softkeys from the front panel:

(System) IBASIC Edit

The system enters the EDIT mode. You can also get into the EDIT mode from the keyboard. Type and press as follows:

EDIT and press (Return)

Getting out of the EDIT Mode

Press the following softkey from the front panel:

END EDIT

The system exits the EDIT mode. If END EDIT does not appear on the softkey menu, press (System) IBASIC from the front panel, END EDIT will appear at the bottom of the menu.

You can also get out of the EDIT mode from the keyboard as follows:

Press (Stop), (ESC), or (Clear display)

Writing Programs

Controlling the Analyzer

HP Instrument BASIC can control the analyzer (itself) through the "internal" HP-IB bus. This means that an analyzer with HP Instrument BASIC includes both a controller and an analyzer in the same instrument. They are connected through an internal HP-IB bus.

Note

The select code of the internal HP-IB interface is 8, and the HP-IB address of the analyzer can be any number from 0 to 30. In this manual, we use "800" for the device selector of the analyzer.

For more information on HP-IB addresses and device selectors, see "Device Selectors" in the *HP Instrument BASIC Interfacing Techniques* of the *HP Instrument BASIC Users Handbook* and "Available I/O Interfaces and Select Codes" in Chapter 9.

You can write the program by using the keyboard or by pressing keys and softkeys from the front panel procedure without using the external keyboard. Using the keyboard is very useful when you write a larger and more complex program, or type comments in a program. For detailed information on how to use the keyboard, see Appendix C.

Let's Try

The following example program selects the following measurement settings:

Active Channel Block	Channel 1 (default)
Measurement Block	Network Analyzer A/R LOG MAG format (default) Display scale to AUTO
Sweep Block	Center frequency: 70 MHz Span frequency: 100 kHz

1. Turn the analyzer ON.
2. Press the following key and softkeys to display the network analyzer mode softkeys:

   (Meas) `ANALYZER TYPE NETWORK ANALYZER RETURN`

3. Press the following key and softkeys from the front panel:

   (System) `IBASIC Edit`

   The system enters the EDIT mode. The cursor appears at line number 10, which is the default line number of the first program line, as follows:

```
10 _
```

4. Press the following softkey:

   `ASSIGN @Hp4396`

The commands are automatically entered at the current cursor position like this:

```
10 ASSIGN @Hp4396 TO 800_
```

5. Press the following key:

   (x1)

   The system reads the entire line.

```
10 ASSIGN @Hp4396 TO 800
20 _
```

6. Press the following softkey:

   OUTPUT @Hp4396

   The following characters are displayed on the screen:

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;""
```

7. Press the following key and softkey to preset the analyzer:

   (Preset)

   The HP-IB command to preset the analyzer ";PRES" is automatically entered at the current cursor position like this:

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
```

   Then press (x1).

Note

";" preceding the HP-IB command is automatically added, when you write the program by pressing keys. ";" is a separator to send more than one command in the same message.

8. Press the following key to select measurement parameter as A/R:

   OUTPUT @Hp4396 (Meas) ANALYZER TYPE NETWORK ANALYZER RETURN A/R

   The program code is automatically generated:

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
30 OUTPUT @Hp4396;";NA;MEAS AR"
```

Then enter (x1).

9. Press the following keys and softkeys to set the center frequency and frequency span:

   (System) IBASIC OUTPUT @Hp4396 (Center) 70(M/μ) (Span) 100 (k/m) (x1)

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
30 OUTPUT @Hp4396;";NA;MEAS AR"
40 OUTPUT @Hp4396;";CENT 70E6;SPAN 100E3"
50 _
```

10. Then press the following keys and softkeys to execute the auto scale function:

    (System) IBASIC OUTPUT @Hp4396 (Scale Ref) AUTO SCALE (x1)

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
30 OUTPUT @Hp4396;";NA;MEAS AR"
40 OUTPUT @Hp4396;";CENT 70E6;SPAN 100E3"
50 OUTPUT @Hp4396;";AUTO"
60 _
```

11. To terminate the program, the END command should be entered. Press the following softkey and key:

    (System) IBASIC END (x1)

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
30 OUTPUT @Hp4396;";NA;MEAS AR"
40 OUTPUT @Hp4396;";CENT 70E6;SPAN 100E3"
50 OUTPUT @Hp4396;";AUTO"
60 END
70 _
```

12. Press the following softkey to exit the EDIT mode:

    END EDIT

The screen returns to the analyzer display.

Running (Executing) Programs

Press the following key and softkeys from the front panel to execute the program:

(System) IBASIC Run

The system executes the program. You can execute the RUN statement from the keyboard. Type and press as follows:

RUN (Return)

Listing Programs

The system can list the program on the screen and to a printer.

Listing on the Screen

You can list a program on the screen as follows:

Let's Try

1. Because the system lists a program in the print area, the Print Area must be allocated on the screen. For example:

   (Display) MORE DISPLAY ALLOCATE ALL BASIC

   All of the screen area is allocated for the print area.

2. Type as follows:

   LIST (Return)

   The system lists the program as follows:

```
10 ASSIGN @Hp4396 TO 800
20 OUTPUT @Hp4396;";PRES"
30 OUTPUT @Hp4396;";NA;MEAS AR"
40 OUTPUT @Hp4396;";CENT 70E6;SPAN 100E3"
50 OUTPUT @Hp4396;";AUTO"
60 END
```

Listing to the Printer

Note For hard copy output, an HP-IB cable must connect the analyzer to the printer.

Let's Try

1. Tell the analyzer the printer's address.
   a. Set the printer's address to 1. If you don't know how to set its address, see the printer's manual.
   b. Check that the address recognized as the printer by the analyzer is 1 (factory set value) as follows:
      (Local) `SET ADDRESSES ADDRESS : PRINTER`

      The address is displayed on the screen. If the address displayed is not 1, press the following keys:
      1 (x1)
2. Set the output device to a printer as follows:

   `PRINTER IS 701` (Return)
3. Type and press as follows:

   `LIST` (Return)

   The program is listed on the printer.
4. Set the output device to CRT as follows:

   `PRINTER IS CRT` (Return)

If You Need More Information

This chapter is an introduction to using HP Instrument BASIC. For more information, see the following chapters and documents:

For more information on	See
EDIT mode	Chapter 5
Keyboard and softkeys	Appendix C
Display Allocation	"(Display)" in Appendix D
HP Instrument BASIC commands	*HP Instrument BASIC Language Reference* of the *HP Instrument BASIC Users Handbook*
HP-IB commands	*HP-IB Command Reference*

4

Saving and Getting Programs

This chapter describes how to save and get programs to or from the built-in flexible disk drive and RAM disk memory. Topics of this chapter are:

- Saving programs (SAVE)
- Listing file names (CAT)
- Getting programs (GET)

If you are using the disk drive for the first time, see "To Save and Recall" in Chapter 6 of the *Task Reference.*

Note HP Instrument BASIC on the analyzer cannot communicate with an external disk drive.

Note The analyzer can use either LIF (Logical Interchange Format) or DOS (Disk Operating System) formatted disks. The instrument automatically detects the disk format. It can use most of the same operations for either disk format.

Saving Programs (SAVE)

1. To use the built-in disk drive, insert a 2DD disk or 2HD disk into the disk drive.
2. If you are using a flexible disk for the first time, set the disk format to LIF or DOS and initialize the disk. See "To Save and Recall" in Chapter 6 of the *Task Reference* for the procedure.

Note When the analyzer is turned on, the RAM disk memory is automatically initialized by the format that is set by `FORMAT [ ]` under `FILE UTILITY` under (Save). If you want to change the disk format, initialize it. See "To Save and Recall" in Chapter 6 of the *Task Reference* for the procedure.

3. If the display allocation is ALL INSTRUMENT, change the allocation. For example:

   (Display) `MORE DISP ALLOCATION ALL BASIC`

4. Specify the system mass storage device as follows:

   When you want to use the built-in disk drive, type in `MSI ":INTERNAL,4"` or `MSI ":,4"`, then press (Return).

   When you want to use the RAM disk memory, type in `MSI ":MEMORY,0"` or `MSI ":,0"`, then press (Return).

5. Press the (Menu) key from the keyboard and press the keys and softkeys and type in the filename to which you will store the program as follows:

(Menu) (on the keyboard) `FILE UTILITY SAVE` *file_name* (Return)

You can also save the file from the keyboard. Type and press as follows:

`SAVE` *file_name* (Return)

The program is stored on the disk.

Note

If you get the error −257, "`File name error`", a file on the disk already has the name you are trying to use. In this case, you have three choices:

- Pick a new file name that doesn't already exist. To determine which file names are already being used, use the "`CAT`" command (see below).
- Replace an existing file, use the "`RE-SAVE`" statement.
- Purge the old file using the `PURGE` command, then save the new one.

Listing File Names (CAT)

Listing to Screen

Press the following keys and softkeys:

1. If the display allocation is ALL INSTRUMENT or BASIC STATUS, change the allocation to either HALF INSTRument HALF BASIC or ALL BASIC. For example:

   (Display) `MORE DISP ALLOCATION ALL BASIC`

2. Press the following keys and softkeys:

   (Menu) (on the keyboard) `FILE UTILITY CAT` (Return)

   You can list from the keyboard as follows:

   Type in `CAT` then press (Return).

   The file names stored on the disk are listed on the screen.

Note

Because the CAT statement outputs 80 columns to a line and the maximum number of columns to a screen is 58, each line is wrapped at the 59th column. If you do not want the list to wrap around, execute the following statement before executing the CAT command.

```
PRINTER IS CRT;WIDTH 80
```

CAT will list the file names with no wrap around, but anything after the 59th column in the output cannot be seen.

Listing to Printer

Note For hard copy output, an HP-IB cable must connect the analyzer to the printer.

1. Tell the analyzer the printer's address.
   a. Set the printer's address to 1. If you don't know how to set its address, see the printer's manual.
   b. Check the address recognized as printer by the analyzer is 1 (factory set value) as follows:
      (Local) SET ADDRESSES ADDRESS : PRINTER

      The address is displayed on the screen. If the address displayed is not 1, press the following keys:
      1 (×1)
2. Set the output device to be a printer as follows:

   PRINTER IS 701 (Return)
3. Press the following keys and softkeys:

   (Menu) (on the keyboard) FILE UTILITY CAT (Return)

   You can list from the keyboard. Type and press as follows:

   CAT (Return)

   The program is listed on the printer.
4. Get the output device back to CRT:

   PRINTER IS CRT (Return)

Getting Programs (GET)

You can retrieve a program from the disk as follows:

1. If the display allocation is ALL INSTRUMENT, change the allocation to either HALF INSTRument HALF BASIC or ALL BASIC. For example:

   (Display) MORE DISP ALLOCATION ALL BASIC
2. Press the following keys and softkeys and type the filename you want to retrieve:

   (Menu) (on the keyboard) FILE UTILITY GET *file-name* (Return)

   You can get the file from the keyboard. Type and press as follows:

   GET *file_name* (Return)

If You Need More Information

This chapter is an introduction to saving and retrieving programs on a disk. For more information, see the following chapters and documents:

For more information on	See
File Utilities for BASIC	"File Utility Menu" in Appendix C.
Initializing a disk	"Save Menu" in Chapter 8 of the *Function Reference.*

5

Editing Programs

This chapter describes how to edit programs using the EDIT mode. The topics covered in this chapter are:

- Getting into/out of the EDIT mode
- Editing programs in the EDIT mode
- Renumbering program line numbers

Getting Into/Out of the EDIT Mode

Getting Into the EDIT Mode using the Front Panel Keys

Pressing the following key and softkey allows you to enter the EDIT mode immediately, irrespective of Display Allocation.

(System) `IBASIC Edit`

Entering the EDIT Mode from the Keyboard

Use the following keys to enter the EDIT mode with the cursor positioned at the specified line number. The *line_number* can be omitted.

(Menu) (on the keyboard) `EDIT` *line_number* (Return)

or

`EDIT` *line_number* (Return)

To use the keyboard, the Keyboard Input Line must be allocated on the screen. If it is not, press (Display) `MORE DISPLAY ALLOCATION` and select any allocation except ALL INSTRUMENT.

Getting Out of the EDIT Mode

The EDIT mode is exited by pressing (Stop), (ESC), and (Clear display) from the keyboard (or by pressing the `END EDIT` softkey).

Editing Programs in the EDIT Mode

This section describes how to edit a program while in the EDIT mode, the topics are:

- Deleting characters
- Inserting characters
- Moving the cursor
- Scrolling lines and pages
- Jumping lines
- Inserting/deleting/recalling lines
- Clearing lines

See Appendix C for more information on functions of each key.

Deleting Characters

There are two functions you can use to delete characters: "Back space" and "Delete characters."

Back Space

Pressing [Back space] on the front panel (or on the keyboard) erases the character to the left of the cursor and moves the cursor left to the position of the erased character.

Deleting Characters

Pressing [Delete char] from the keyboard deletes the character at the cursor's position.

Inserting Characters

The EDIT mode is always in the insert mode. Characters you type at the keyboard are inserted before the current cursor position. (Pressing [Insert char] performs no function.)

Moving the Cursor

The following key operations allow you to move the cursor horizontally along a line:

From the front panel	From the keyboard
Turning the knob	Pressing ◀ and ▶

Scrolling Lines and Pages

Scrolling Lines

The following key operations enable you to scroll lines up and down:

From the front panel	From the keyboard
Pressing ⇧ and ⇩	pressing ▲ and ▼

Scrolling Pages

Pressing [Prev] and [Next] from the keyboard causes the display to scroll up and down in one-half page increments.

Jumping from the Current Line

Jumping to a Specified Line

You can specify a line by using a line number or a label name when jumping from the current line as follows:

`GOTO LINE` *line_number* (Return)

or

`GOTO LINE` *label_name* (Return)

If the label specified is not defined in the program, an error will occur.

Jumping to the Top/Bottom of a Program

Pressing the following keys allows you to jump to top or bottom of the program:

(Shift)-(▲)

(Shift)-(▼)

Inserting/Deleting/Recalling Lines

(Insert line) inserts a new line above the current cursor position.

(Delete line) deletes the line at which the cursor is.

`RECALL LINE` recalls the last deleted line.

Clearing Line

Pressing (Clear line) clears a line from the current cursor position to the end of the line.

Renumbering Program Line Numbers

The `REN` command allows you to renumber the program currently in memory. You should execute the `REN` command after exiting the EDIT mode. Press the following keys and softkey, to renumber a program.

(Menu) (on the keyboard) `RENumber` (Return)

or

`REN` (Return)

You can specify the starting value, increment value, beginning line number, and the ending line number when renumbering a program as follows:

(Menu) (on the keyboard) `RENumber` *starting_value*, *increment* `IN` *beginning_line_number*, *ending_line_number*

or

`REN` *starting_value*, *increment* `IN` *beginning_line_number*, *ending_line_number*

line_label can be also use instead of *line_number*. For more information, see the *HP Instrument BASIC Language Reference* of the *HP Instrument BASIC Users Handbook*.

6

Application Programs

This chapter describes HP Instrument BASIC programming using examples. The examples correspond to actual measurement situations. These HP Instrument BASIC examples will supply useful information for developing the analyzer's HP Instrument BASIC application programs. The topics covered in this chapter are:

- Controlling the analyzer using HP Instrument BASIC
- I/O operation from HP Instrument BASIC
- Using HP Instrument BASIC with an external controller
- Sharing one printer between two controllers
- Loading HP Instrument BASIC programs using softkeys

Controlling the Analyzer Using HP Instrument BASIC

HP Instrument BASIC allows you to easily control the analyzer. This chapter describes the basic techniques for using HP Instrument BASIC to control the analyzer.

Note

Two quotes, in succession, will embed a quote within a string when a quotation mark needs to be in a string.

For example:

```
100 OUTPUT @Hp4396;";TITL ""This is a test."""
```

or

```
100 Title$="This is a test."
110 OUTPUT @Hp4396;";TITL """;Title$;""""
```

Sends string, ;TITL "This is a test.", to the analyzer. (TITL displays a title.)

The analyzer and the HP Instrument BASIC in the analyzer should be regarded as two separate instruments interfaced by an internal HP-IB bus. So, to distinguish between the internal and external HP-IB interfaces, use select code "8" for the internal HP-IB interface (the external select code is "7"). For more information on HP-IB commands, see *HP-IB Command Reference* and the *HP-IB Programming Guide*. This program sends the HP-IB command by using the HP-IB interface from HP Instrument BASIC to the analyzer.

```
10 ASSIGN @Hp4396 TO 800  ! Assign HP-IB path to the analyzer
20 OUTPUT @Hp4396;";PRES" ! Preset the analyzer.
30 END
```

Figure 6-1. Sending HP-IB Command

Note For sample programs to control the analyzer, see the *HP-IB Programming Guide.*

I/O Operation from HP Instrument BASIC

This paragraph describes the input/output operations using the I/O port and the storage unit. The following programs are covered in this section:

- Data transfer using the I/O port
  - Reading data from the I/O port
  - Writing data to the I/O port
- Disk I/O for a storage unit
  - Saving trace data
  - Loading trace data

Data Transfer Using the I/O Port

The following two examples show input and output operations of the I/O port. The `READIO` and `WRITEIO` commands of HP Instrument BASIC directly control the I/O port and are faster than the `INP8IO?` and `OUTP8IO` HP-IB commands.

Reading Data from the I/O Port

This program shows how to directly read a specific data bit from the I/O port.

```
10 A=READIO(15,0)
20 PRINT A
30 END
```

Figure 6-2. Reading I/O Port

Writing Data to the I/O Port

This program shows an example of writing data to the I/O port. When you use the output port of the I/O port, the output data must be decimal data. Binary-expressed data is useful to set each bit ON or OFF. If you want to set bits of the output port using binary data, use the `IVAL` or `DVAL` command of HP Instrument BASIC. This command allows you to convert data from binary to decimal. The following example shows how to write binary data to the I/O port by using the `DVAL` command.

```
10 Bin_dat$="11111111"
20 Decimal_dat=DVAL(Bin_dat$,2) ! Convert binary data to decimal
30 WRITEIO 15,0;Decimal_dat
40 END
```

Figure 6-3. Writing Data to the I/O Port

Disk I/O for a Storage Unit

The analyzer has a built-in disk drive and RAM disk memory. You can save or get data using these disks with HP Instrument BASIC.

Saving Trace Data

This program saves the analyzer's current raw measurement data to an arbitrarily named file.

```
10 DIM File_name$[10]
20 ASSIGN @Hp4396 TO 800
30 INPUT "ENTER FILE NAME (up to 10 Characters)",File_name$
40 OUTPUT @Hp4396;"SAVDDAT """;File_name$;"""""
50 END
```

Figure 6-4. Saving Trace data

Loading Trace Data

This program loads trace data from the built-in disk drive into the "Dat" array.

```
10 DIM Dat(1:201,1:2)
20 DIM File_name$[10]
30 ASSIGN @Hp4396 TO 800
40 MSI ":INTERNAL,4"
50 INPUT "ENTER FILE NAME (without EXT.)",File_name$
60 File_name$=File_name$&".DAT"
70 ASSIGN @File TO File_name$ ! Open target file
80 ENTER @File USING "16X,#"
90 ENTER @File USING "12X,#"
100 ENTER @File;Dat(*)        ! Load data from file
110 ASSIGN @File TO *         ! Close file
120 PRINT Dat(*)
130 END
```

Figure 6-5. Loading Trace Data

Line 40 selects the internal flexible disk drive. When you want to use the RAM disk memory, change ":INTERNAL,4" to ":MEMORY,0".

Line 60 adds an extension ".DAT" to file name for the DOS format file. When you want to use LIF format file, change ".DAT" to "_D".

Using HP Instrument BASIC with an External Controller

This program transfers a program from the HP Instrument BASIC memory to the external controller's disk through the HP-IB interface. This program must be executed on the external controller.

Note

For other topics listed below, see Chapter 7, "Controlling HP Instrument BASIC from Remote," of the *HP-IB Programming Guide.*

- Passing control between controllers
- Transferring a program to HP Instrument BASIC
- Running HP Instrument BASIC program from an external controller program
- Referring to an external controller's data array contents

```
10 DIM A$[10000]
20 ASSIGN @Hp4396 TO 717
30 OUTPUT @Hp4396;"*RST"
40 OUTPUT @Hp4396;":PROG:DEF?"
50 ENTER @Hp4396 USING "#,2A";Head$
60 B=VAL(Head$[2])
70 FOR I=1 TO B
80   ENTER @Hp4396 USING "%,A";Head$
90 NEXT I
100 ENTER @Hp4396 USING "-K";A$ ! Transfer the program
110 !
120 INPUT "File name?",File_name$
130 CREATE ASCII File_name$,1
140 ASSIGN @File TO File_name$
150 OUTPUT @File;A$
160 ASSIGN @File TO *
170 END
```

Figure 6-6.
Transferring the Program to an External Controller (on the External Controller)

Lines 50 to 90 read the file header: `#NMM ... M`.

The first byte is always "#".
`N` specifies the number of bytes that defines the program size.
`MM ... M` is program size in byte (`N` digits).

See `:PROGram[:SELected]:DEFine` in Chapter 2 of the *HP-IB Command Reference* for more information.

Note

The program to be uploaded must be in either the paused or stopped state.

Sharing One Printer Between Two Controllers

This program shows an example of sharing one printer between two controllers. The analyzer and the external controller use the printer in sequence. The external controller uses the printer first. The following is assumed:

- Two controllers and one printer on the same HP-IB bus
- Figure 6-7 is executed on the external controller
- Figure 6-8 is in the HP Instrument BASIC editor

```
10    Hp4396=717
20    Printer=701
30    !
40    OUTPUT Hp4396;":PROG:STAT RUN" ! Make HP Instrument BASIC run state
50    !
60    PRINTER IS Printer
70    PRINT "This line is printed out from ext. controller."
80    !
90    PASS CONTROL Hp4396
100   !
110   ON ERROR GOTO Not_active
120 Not_active:   ! Waiting until control is back
130   !
140   PRINT "This line is printed out from ext. controller again."
150   PRINTER IS CRT
160   END
```

Figure 6-7. Sharing a Printer (Program for External Controller)

```
10 ASSIGN @Hp4396 TO 800
20 Printer=701
30 !
40 PRINTER IS Printer
50 !
60 ON ERROR GOTO Not_active
70 Not_active:!
80 !
90 PRINT "This line is printed from IBASIC."
100 !
110 PASS CONTROL 721
120 PRINTER IS CRT
130 END
```

Figure 6-8. Sharing a Printer (Program for HP Instrument BASIC)

Loading HP Instrument BASIC Programs Using Softkeys

This program displays up to eight program file names in the analyzer's softkey label area. One of the programs can be selected and executed by just pressing a softkey. This feature lets you execute a program without using the keyboard. You only need to select the softkey of the program you want to execute.

You can name this program file, "AUTOST", so it will be executed automatically when the analyzer is turned ON.

When you want to recall this program again after the execution of an object file, you simply add the command `GET "AUTOST"` just before the `END` statement line of your object program code.

```
10 ASSIGN @Hp4396 TO 800
20 DIM Dir$(1:200)[80],File$(1:200)[10]
30 !
40 CAT TO Dir$(*)
50 !
60 File_number=0
70 REPEAT
80 File_number=File_number+1
90 File$(File_number)=Dir$(File_number+7)[1,10]
100 UNTIL File$(File_number)="" OR File_number>200
110 !
120 Max_page=INT((File_number-1)/6)+1
130 Npage=1
140 OUTPUT @Hp4396;"KEY 47" ! SYSTEM key
150 OUTPUT @Hp4396;"KEY 0"  ! IBASIC key
160 OUTPUT @Hp4396;"KEY 7"  ! ON KEY LABEL key
170 Head: !
180 Page=(Npage-1)*6
190 ON KEY 1 LABEL File$(Page+1) GOSUB Jump1
200 ON KEY 2 LABEL File$(Page+2) GOSUB Jump2
210 ON KEY 3 LABEL File$(Page+3) GOSUB Jump3
220 ON KEY 4 LABEL File$(Page+4) GOSUB Jump4
230 ON KEY 5 LABEL File$(Page+5) GOSUB Jump5
240 ON KEY 6 LABEL File$(Page+6) GOSUB Jump6
250 ON KEY 7 LABEL "NEXT PAGE" GOTO Jump7
260 ON KEY 8 LABEL "PREV. PAGE" GOTO Jump8
270 !
280 LOOP
290 END LOOP
300 !
310 Jump1:GET File$(Page+1)
320 Jump2:GET File$(Page+2)
330 Jump3:GET File$(Page+3)
340 Jump4:GET File$(Page+4)
350 Jump5:GET File$(Page+5)
360 Jump6:GET File$(Page+6)
370 Jump7:IF Npage<Max_page THEN Npage=Npage+1
380 GOTO Head
390 Jump8:IF Npage>1 THEN Npage=Npage-1
400 GOTO Head
410 !
420 END
```

Figure 6-9. Loading HP Instrument BASIC Programs Using Softkeys

7

Program I/O

This chapter describes how to write programs that use the CRT, the I/O port, the external RUN/CONT connector in the analyzer, and the DOS file system.

Topics covered in this chapter are:

- Graphics
- Using the external RUN/CONT connector
- File system exceptions
- Using the I/O port in BASIC programs

Graphics

HP Instrument BASIC adds graphics capability to the analyzer. You can draw pictures on the CRT display independent of the grids and traces.

The analyzer has two screens, the instrument screen and the graphics screen. These two screens are always displayed together on the CRT and are not separately selectable. The instrument screen consists of a trace display area and a softkey label area. The HP Instrument BASIC editor is also displayed on the trace display area. The graphics screen covers the entire instrument screen as shown in Figure 7-1. The graphics screen is like an independent transparent overlay in front of the instrument screen. Therefore, you can draw figures in both the trace display and softkey label areas.

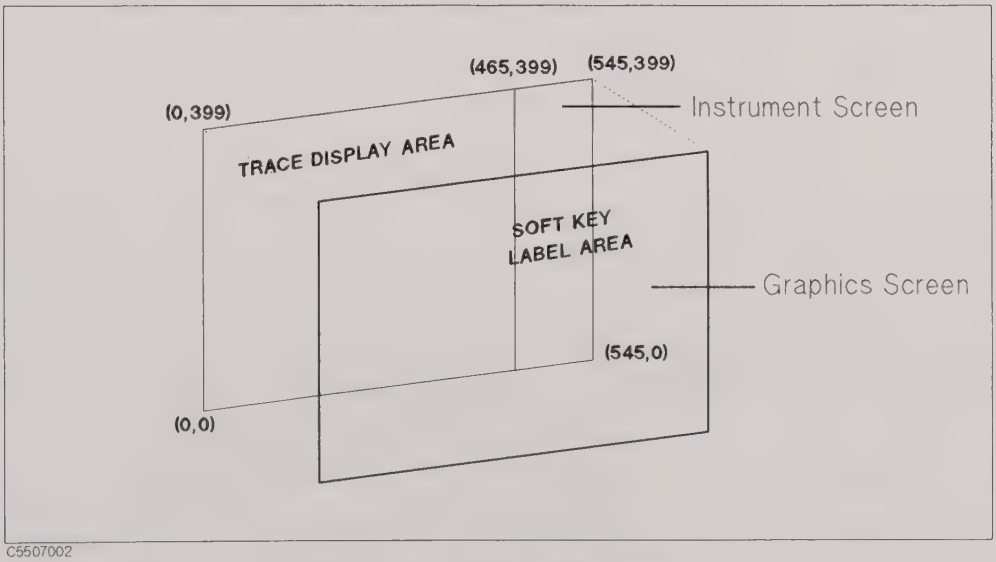


Figure 7-1. Screen Structure

Each point on the graphics screen is addressable using a coordinate address as shown in Figure 7-1. The bottom left corner is the origin (0,0) and the top right corner is the maximum horizontal and vertical end points (393,299). The MOVE and DRAW statement parameters are specified using these coordinate values. Because the aspect ratio of a graphics screen is 1, you need not adjust the aspect ratio when drawing figures.

HP Instrument BASIC Graphics Commands

The analyzer's HP Instrument BASIC has three graphics commands; MOVE, DRAW, and GCLEAR.

`MOVE`	Moves the pen from its current position to the specified coordinates.
`DRAW`	Draws a line from the current pen position to the specified coordinates.
`GCLEAR`	Clears the graphics screen, moves the pen from its current position to the origin (0,0), and selects pen 1.

Note The total times of executing the `MOVE` and `DRAW` commands is up to 1933, even if the pen position is not changed.

Hard Copies

Graphics hard copies can be obtained with the printing or plotting function.

PLOT

`PLOT` under Copy plots the display image (both of an instrument screen and a graphics screen) to a graphics plotter. Plotter pens are specified by the PEN number.

PRINT

`PRINT` under Copy prints a display image on a printer. See "Copy Menu" in Chapter 8 of the *Function Reference*.

Initial settings

When power is turned ON, the default settings are as follows:

- MOVE 0,0

Example of Graphics Programming

This section describes an example of a simple program for drawing lines on the graphics screen.

- Drawing a Straight Line

  The following HP Instrument BASIC program will draw a line from coordinate (50,200) to coordinate (300,200) on the display.

```
GCLEAR                  ! INITIALIZE GRAPHICS MODE
MOVE 50,200             ! MOVE PEN TO COORDINATE  (50,200)
DRAW 300,200            ! DRAW A LINE TO COORDINATE (300,200)
END
```

- Drawing a Circle

Trying to express all graphical images using only straight lines is tedious, slow, and difficult. This example describes a subprogram you can use to draw a circle. It can draw a circle by passing the center coordinates and the radius as arguments to the following subroutine. This subroutine can be used as a base for drawing arcs, setting different values for Theta, etc.

```
SUB Drawcircle(Centx,Centy,R)    !
  DEG                            ! USE DEGREES FOR ANGLE EXPRESSIONS
  X=Centx+R                      !
  Y=Centy                        !
  MOVE X,Y                       ! MOVE PEN TO INITIAL POINT
  For Theta=1 to 360             !
    X=INT(COS(Theta)*R+Centx)    ! NEXT X COORDINATE ON CIRCLE
    Y=INT(SIN(Theta)*R+Centy)    ! NEXT Y COORDINATE ON CIRCLE
    DRAW X,Y                     ! DRAW LINE TO NEXT POINT ON CIRCLE
  NEXT Theta                     ! UNTIL STARTING POINT IS REACHED
SUBEND                           !
```

Using the External RUN/CONT Connector

You can use the RUN or CONT commands in a program by inputting a TTL-compatible signal to the External RUN/CONT connector on the rear panel. At the negative-going edge of a pulse more than 20 μs wide (T_p) in the LOW state will trigger RUN or CONT.

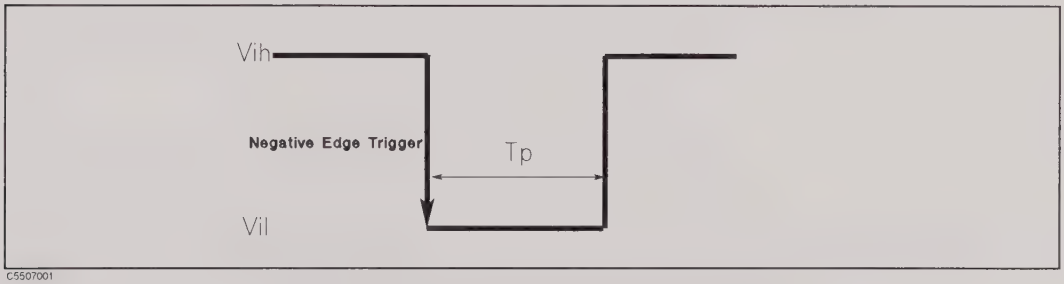


Figure 7-2. RUN/CONT Trigger Signal

File System Exceptions

The analyzer supports both the LIF and DOS file formats. When using an LIF format disk, the CREATE and CREATE DIR commands will generate an error.

Because the analyzer does not support an external disk drive, the MASS STORAGE IS (MSI) statement cannot specify volumes other than the built-in disk drive (volume specifier "INTERNAL,4", the default volume) and RAM disk memory (volume specifier "MEMORY,0").

Using the I/O Port in BASIC Programs

The HP Instrument BASIC can directly control the I/O port without using HP-IB commands. This is faster than using the `INP8IO?` and `OUTP8IO` HP-IB commands.

`READIO(15,0)`	Reads the 4-bit data from the I/O Port and returns a decimal value.
`WRITEIO 15,0;`*data*	Outputs the decimal value of the 8-bit data to the OUT 0 to 7 lines of the I/O port. The OUT 0 signal is the LSB (least significant bit), while the OUT 7 signal is the MSB (most significant bit).

See Appendix B for more information on `READIO` and `WRITEIO` commands.

For more information on the I/O port, see "I/O port" in Chapter 12 of the *Function Reference.*

8

Special Features and Advanced Techniques

The topics covered in this chapter are :

- Autoloading and running a program automatically (AUTOST)
- On Key Label function
- Increasing program speed

Autoloading and Running a Program Automatically (AUTOST)

The analyzer allows you to create a special program file called AUTOST. This program is automatically loaded and run every time the analyzer is turned ON.

When you use this capability, the disk on which you saved AUTOST must be inserted in the disk drive before the analyzer is turned ON.

The system first checks to see if there is an AUTOREC file on the disk. If there is, the system reads the AUTOREC file to set up the analyzer, and then loads and runs the AUTOST program. (For more information on AUTOREC, see "Auto Recall Function" in Appendix C of the *Function Reference.)*

On Key Label Function

The HP Instrument BASIC allows you to define softkeys from within a program. The softkey labels you define will appear when pressing the (User) key on the Keyboard. The labels are displayed while running the program.

The `ON KEY` statement is used to define the softkeys. For example:

```
.....
100 ON KEY 1 GOTO 150
110 ON KEY 2 LABEL "Print" GOSUB Report
.....
```

The `KEY` statement is used to display the softkey labels defined. The following set of statements is the same as the key strokes (System) `IBASIC ON KEY LABELS` :

```
.....
200 OUTPUT @Hp4396;"KEY 47"      ! SYSTEM key
210 OUTPUT @Hp4396;"KEY 0"       ! IBASIC softkey
220 OUTPUT @Hp4396;"KEY 7"       ! ON KEY LABELS softkey
.....
```

For more information on the ON KEY statement, see the *HP Instrument BASIC Language Reference* of the *HP Instrument BASIC Users Handbook.*

Example programs for ON KEY LABEL keys are shown in Chapter 6.

Increasing Program Speed

Because the analyzer's CPU interleaves processing measurements and executing a program, program execution speed depends on the measurement conditions. The display process also requires processing time.

To increase program speed (increase throughput), set the analyzer to the following conditions:

- If you do not need to measure the DUT when executing a program, set TRIGGER MODE to HOLD.
- If you need to measure the DUT but do not need to display the traces on the screen, set DISPLAY ALLOCATION to ALL BASIC.
- If you need to measure the DUT and display traces, but do not need to use the marker function, preset all markers.
- When you use the I/O port, use the `READIO` and `WRITEIO` commands to input or output data to the port directly.
- If you change channels in a program, set Dual Channel to ON before changing channels to avoid the setup time for the channel.

For example, when you change channels in a program, set Dual Channel to ON and Display Allocation to All BASIC to decrease the switching time between channels 1 and 2.

9

Analyzer Specific HP Instrument BASIC Features

This chapter lists and summarizes the HP Instrument BASIC features specific to the analyzer. Details of each feature are described in the previous chapters and in the appendixes.

This chapter covers the following topics:

- Available I/O interfaces and select codes
- Storage units
- HP-IB commands for HP Instrument BASIC

Available I/O Interfaces and Select Codes

Available interfaces and their select codes in the analyzer's HP Instrument BASIC are listed in the following table:

Select Codes	Devices
1	CRT
2	Keyboard
7	External HP-IB interface
8	Internal HP-IB interface

Note The analyzer does not have an RS-232C interface.

Storage Unit

The analyzer has two types of storage units: the built-in flexible disk drive and the RAM disk memory. Both the disk drive and RAM disk memory support the LIF and DOS formats.

To switch the system's storage units between the disk in the disk drive and the RAM disk under control of HP Instrument BASIC,

`MSI ":INTERNAL,4"` or `MSI ":,4"` for the built-in disk drive
`MSI ":MEMORY,0"` or `MSI ":,0"` for the RAM disk memory

Note

When you want to manage the storage units using the following HP-IB commands, use the `STODDISK` command (for the built-in disk drive) or the `STODMEMO` command (for the RAM disk memory) to specify the storage unit.

- CHAD
- CRED
- DISF
- INID
- PURG
- RECD
- RESAVD
- SAVDASC
- SAVDDAT
- SAVDGRA
- SAVDSTA

To copy a file between the disk and RAM disk, use an `FILC` command.

Note

The `FILC` command cannot be used to copy a file if the format (LIF or DOS) of the disk in the built-in disk drive is different from that of the RAM disk.

Use the front panel key or enter an HP-IB command to initialize the storage unit. (For the procedure for initialization using the front panel, see Chapter 6 of the *Task Reference.*) When using an HP-IB command to initialize the storage unit, execute the following procedure:

```
10  ASSIGN @Hp4396 TO 800
20  OUTPUT @Hp4396;"STODDISK"  ! Selects the built-in disk drive
30  OUTPUT @Hp4396;"DISF DOS"  ! Selects the DOS format
40  OUTPUT @Hp4396;"INID"      ! Initializes the disk
50  END
```

Built-in Flexible Disk Drive

The analyzer's HP Instrument BASIC has the following disk drive limitations:

- Disk types which can be initialized by the analyzer's HP Instrument BASIC `INITIALIZE` statement are 720 Kbyte (2DD) and 1.44 MByte (2HD). 270 Kbyte disks cannot be initialized.
- The only `INITIALIZE` format option is the default (256 byte/sector).
- DOS formats supported. The DOS formats supported are:

  720 Kbyte, 80 tracks, double-sided, 9 sectors/track
  1.44 Mbyte, 80 tracks, double-sided, 18 sectors/track
- HFS format is not supported.
- External disk drives are not supported.

RAM Disk Memory

A part of the RAM of the analyzer can be used as a virtual disk drive; RAM disk memory. RAM disk memory can be operated in the same way as the internal disk drive.

When the analyzer is turned OFF, the data saved in the RAM disk is lost, and the RAM disk memory is automatically initialized by the format that is set by `FORMAT [ ]` under `FILE UTILITIES` under (Save).

HP-IB Commands for HP Instrument BASIC

The PROGram subsystem commands of the analyzer's HP-IB commands are used to control HP Instrument BASIC. The PROGram subsystem commands do the following:

- Download the program from an external controller to the analyzer
- Upload the program from the analyzer to an external controller
- Delete the program on the BASIC editor of the analyzer
- Execute the program on the BASIC editor of the analyzer
- Set or query the variables and arrays in the program on the BASIC editor of the analyzer
- Set or query the state of the program on the BASIC editor of the analyzer

See the *HP-IB Command Reference* for more information and the *Programming Guide* for their usage example.

Note

The PROGram subsystem commands can be used from an external controller only.

A

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the analyzer than the current printing date of this manual. The information in this manual applies directly to the HP 4396A Network/Spectrum Analyzer serial number prefix listed on the title page of this manual.

Manual Changes

To adapt this manual to your HP 4396A, see Table A-1 and Table A-2, and make all the manual changes listed opposite your instrument's serial number and firmware version.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument's serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

In additions to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest *MANUAL CHANGES* supplement.

For information concerning serial number prefixes not listed on the title page or in the *MANUAL CHANGES* supplement, contact the nearest Hewlett-Packard office.

Turn on the line switch or execute the `*IDN?` command by HP-IB to confirm the firmware version. See the *HP-IB Command Reference* manual for information on the `*IDN?` command.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
3241J	Change 1

Table A-2. Manual Changes by Firmware Version

Version	Make Manual Changes
1.0	Change 1

Instruments Covered by This Manual

Hewlett-Packard uses a two-part, nine-character serial number that is stamped on the serial number plate (see Figure A-1) attached to the rear panel. The first four digits and the letter are the serial prefix and the last five digits are the suffix.

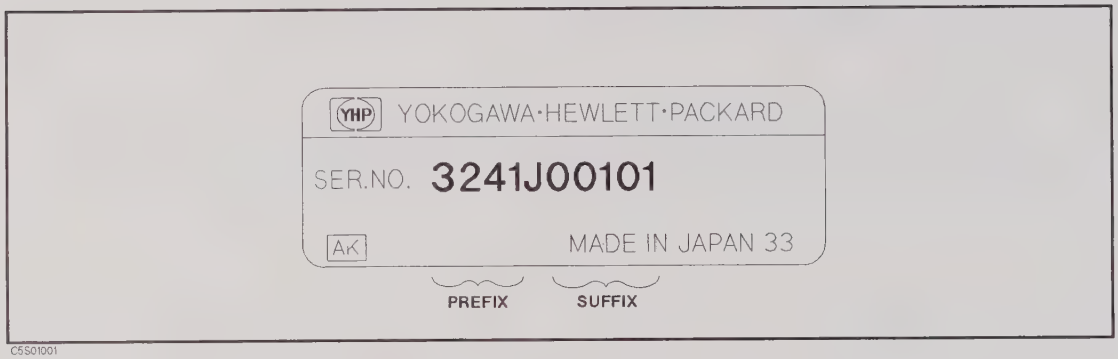


Figure A-1. Serial Number Plate

Change 1

Appendix B

EXECUTE command is not supported. Please delete all descriptions about EXECUTE command.

B

BASIC Commands Specific to HP 4396A

BASIC Commands Not Implemented

The following commands are listed in the *HP Instrument BASIC Language Reference* of the *HP Instrument Users Handbook*, but are not implemented in the analyzer's HP Instrument BASIC.

- OFF CYCLE
- ON CYCLE

Note

GCLEAR and ON TIMEOUT commands are available, but the following supplementary items are added.

- GCLEAR

  Moves the pen to (0,0).

- OFF TIMEOUT and ON TIMEOUT

  The interface select code is 7 only.

BASIC Commands Specific to HP 4396A

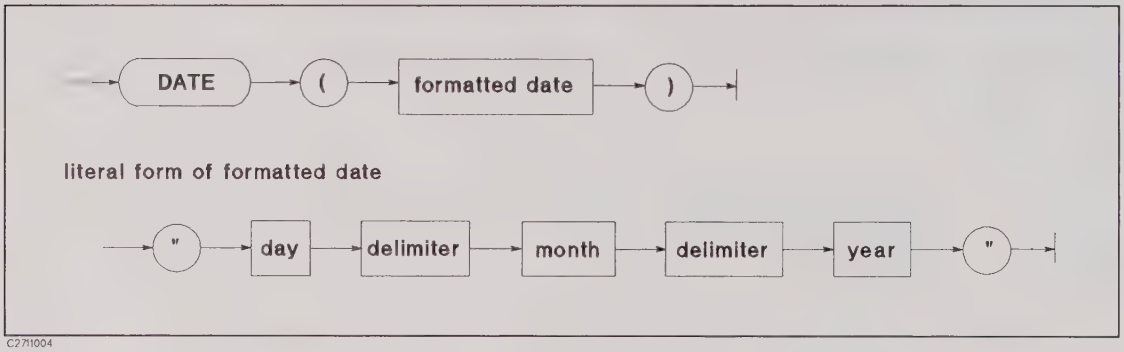
The following commands are *not* listed in the *HP Instrument BASIC Language Reference* of the *HP Instrument BASIC Users Handbook*, but are available in the analyzer's HP Instrument BASIC.

- DATE
- DATE$
- EXECUTE
- READIO
- SET TIME
- SET TIMEDATE
- TIME
- TIME$
- WRITEIO

DATE

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command converts data formatted as (DD MMM YYY) into the numeric value used to set the clock.



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Item	Description	Range
formatted date	string expression	(see drawing and text)
day	integer constant	1 to end-of-month
month	Literal (letter case ignored)	JAN, FEB, MAR, APR, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC
year	integer constant	1900 to 2079

- Example Commands

```
PRINT DATE("21 MAY 1991")
SET TIMEDATE DATE("1 Jan 1991")
Days=(DATE("1 JAN 1991")-DATE("11 NOV 1990")) DIV 86400
```

- Semantics

  Using a value from the DATE command as the argument for SET TIMEDATE will set the clock to midnight on the date specified. The results from the DATE and TIME commands must be combined to set the date and time of day.

  If the DATE command is used as an argument for SET TIMEDATE to set the clock, the date must be in the range: 1 Mar 1900 to 4 Aug 2079.

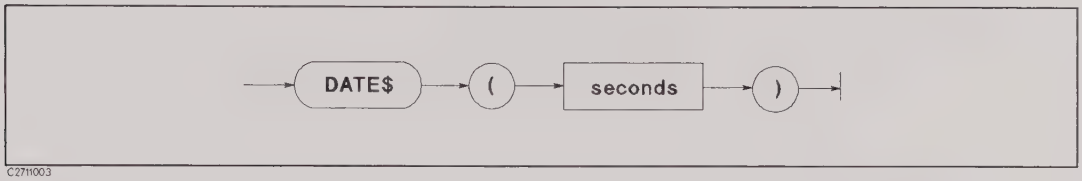
  Specifying an invalid date, such as the thirty-first of February, will cause an error.

  Leading blanks or non-numeric characters are ignored. ASCII spaces are recommended as delimiters between the day, month, and year. However, any non-alphanumeric character except the negative sign (–), may be used as the delimiter.

DATE$

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command formats the number of seconds into a date (DD MMM YYY).



Item	Description	Range
seconds	numeric expression	−4.623683256E+12 to 4.6534263350399E+13

- Example Commands

```
PRINT DATE$(TIMEDATE)
DISP DATE$(2.111510608E+11)
```

- Semantics

  The date returned is in the form: DD MMM YYYY, where DD is the day of the month, MMM is the month, and YYYY is the year.

  The day is a blank filled to two character positions. Single ASCII spaces delimit the day, month, and year.

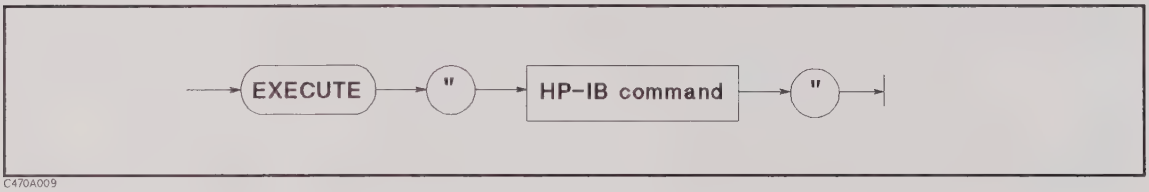
  The first letter of the month is capitalized and the rest are lowercase charters.

  Years less than the year 0 are expressed as negative years.

EXECUTE

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command executes specific HP-IB commands faster than the OUTPUT statement.



C470A009

Item	Description	Range
HP-IB command	string expression	refer to Table B-1

Table B-1. HP-IB Commands for EXECUTE

ANAOCH1	NUMLMAX?	PEAN?
ANAOCH2	NUMLMIN?	POLE?
ANAODATA	OUTPMAX?	RPLENV?
ANAOMEMO	OUTPMEAN?	RPLHEI?
ANARANG	OUTPMIN?	RPLLHEI?
ANARFULL	OUTPMINMAX?	RPLMEA?
EQUCPARA?	OUTPCERR?	RPLPP?
EQUCPARS?	OUTPCFIL?	RPLRHEI?
EQUCPARS4?	OUTPFILT?	RPLVAL?
EQUCO?	OUTPRESF?	SING
EQUM	OUTPRESO?	TARL?
LMAX?	OUTPRESR?	TARR?
LMIN?	OUTPXFIL?	THRR
NEXPK?	PEAK?	

- Example Commands

```
EXECUTE "SING"
EXECUTE "ANAOCH1"
```

- Semantics
  - Handling HP-IB command parameters and a query command's return value when an HP-IB command is executed by the `execute` command:

    To transfer HP-IB command parameters, use a `WRITEIO` command. This command must be executed before the `EXECUTE` command. One `WRITEIO` command is required to transfer one parameter. For example, to transfer two `ANARANGE` command parameters to the EXECUTE command, write the program as follows:

```
WRITEIO 8,0; 100E6
WRITEIO 8,1: 200E6
EXECUTE "ANARANG"
```

    To receive a query command's return value, use a `READIO` function. The `READIO` function returns only one specified return value. For example, four return values (`Za`, `Fa`, `Zr`, and `Fr`) of the query command `OUTPRESO?` must be received by writing the program as follows:

```
EXECUTE "OUTPRESO?"
Za=READIO(8,0)
Fa=READIO(8,1)
Zr=READIO(8,2)
Fr=READIO(8,3)
```

  - HP-IB Commands that work differently when executed by the `EXECUTE` command:

    When the following HP-IB command is executed by the `EXECUTE` command, it works differently than when it is executed by the `OUTPUT` command.

`SING`	The HP 4396A executes `EXECUTE "SING"` to sweep once. Execution of the next statement is suppressed until the sweep is completed. Therefore, the completion of the sweep need not be supervised using a status register.

Note

When both an external controller and HP instrument BASIC are used at the same time, the EXECUTE command occasionally does not terminate normally. If the external controller queries the instrument while the HP 4396A is sweeping when triggered by EXECUTE "SING", the EXECUTE command does not terminate normally (In the worst case, a system halt occurs).

To avoid this problem, it is necessary to use an SRQ interrupt technique that uses the status register. In this case, the external controller waits to send query commands until HP Instrument BASIC completes the execution of the EXECUTE command.

- For External Controller

```
 10  REAL Meas(1)
 20  ASSIGN @Hp4396 TO 717
 30  OUTPUT @Hp4396;"*CLS; *OPC?"
 40  ENTER @Hp4396;Opc
 50  OUTPUT @Hp4396;"OSPT 0"
 60  ON INTR 7 GOTO Anaend
 70  OUTPUT @Hp4396;"PROG:STAT RUN"
 80  !
 90 Start:!
100  OUTPUT @Hp4396;"*CLS; *OPC?"
110  ENTER @Hp4396;Opc
120  ENABLE INTR 7;2
130 Waiting: GOTO Waiting
140 Anaend:!
150  OUTPUT @Hp4396;"PROG:NUMB? MEAS"
160  ENTER @Hp4396;Meas(*)
170  PRINT Meas(*)
180  OUTPUT @Hp4396;"*CLS; *OPC?"
190  OUTPUT @Hp4396;"PROG:STAT CONT"
200  GOTO Start
210  END
```

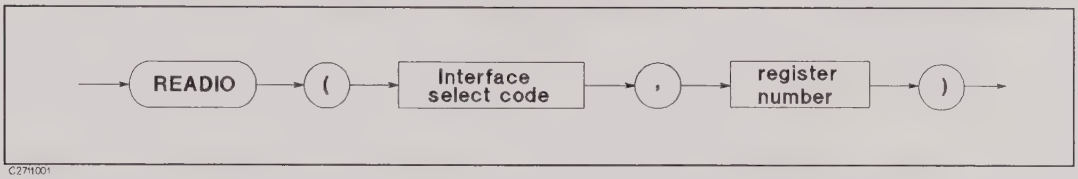
- For HP Instrument BASIC

```
 10 REAL Meas(1)
 20 ASSIGN @Hp4396 TO 800
 30 OUTPUT @Hp4396;"OSE 16384;OSNT 16384;*SRE 128"
 40 !
 50 LOOP
 60  EXECUTE "ANAOCH1;ANAODATA;ANARFULL"
 70  EXECUTE "SING"
 80  EXECUTE "OUTPMAX?"
 90  Meas(0) = READIO(8,0)
100  Meas(1) = READIO(8,1)
110  PAUSE
120 END LOOP
```

READIO

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command reads the contents of the register used for an I/O port or EXECUTE command.



Item	Description	Range
select code	numeric expression	8: EXECUTE register 15: I/O port
register number	numeric expression	0 to 800 (Select code 8) 0: I/O port

- Example Commands

```
Ioport=READIO(15,0)

100  EXECUTE "OUTPRESO?"
110  Za=READIO(8,0)
120  Fa=READIO(8,1)
130  Zr=READIO(8,2)
140  Fr=READIO(8,3)
```

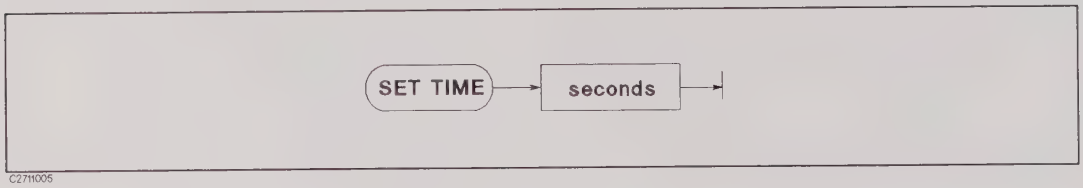
- Semantics

The EXECUTE command stores the query command's return values in registers. The READIO command reads a return value from one of these registers. Return values are sequentially stored in registers 0 to 3. For example, when EXECUTE"OUTPURESO?" is executed, four return values Za, Fa, Zr, and Fr are stored in four registers, register 0 to register 3. Za is stored in register 0, Fa in register 1, Zr in register 2, and Fr in register 3. To read a return value stored by the READIO command, specify the appropriate register number. For more information on EXECUTE command, see the example in the "EXECUTE" command.

SET TIME

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command resets the time-of-day given by the real-time clock.



Item	Description	Range
seconds	numeric expression, rounded to the nearest hundredth	0 to 86399.99

- Example Commands

```
SET TIME 0
SET TIME Hours*3600+Minutes*60
```

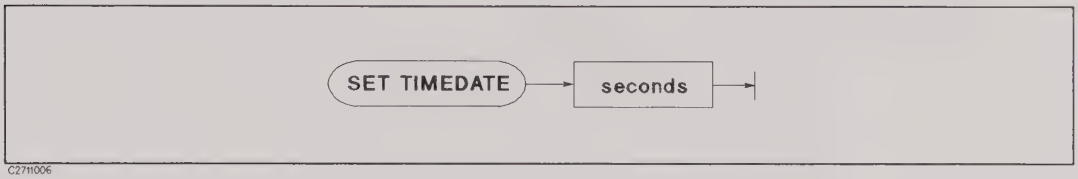
- Semantics

  This command changes only the time within the current day, not the date. The new clock setting is equivalent to (TIMEDATE DIV 86400)×86400 plus the specified setting.

SET TIMEDATE

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command resets the absolute seconds (time and day) given by the real-time clock.



Item	Description	Range
seconds	numeric expression, rounded to the nearest hundredth	2.08662912E+12 to 2.143252224E+11

- Example Commands

```
SET TIMEDATE TIMEDATE+86400
SET TIMEDATE Strange_number
```

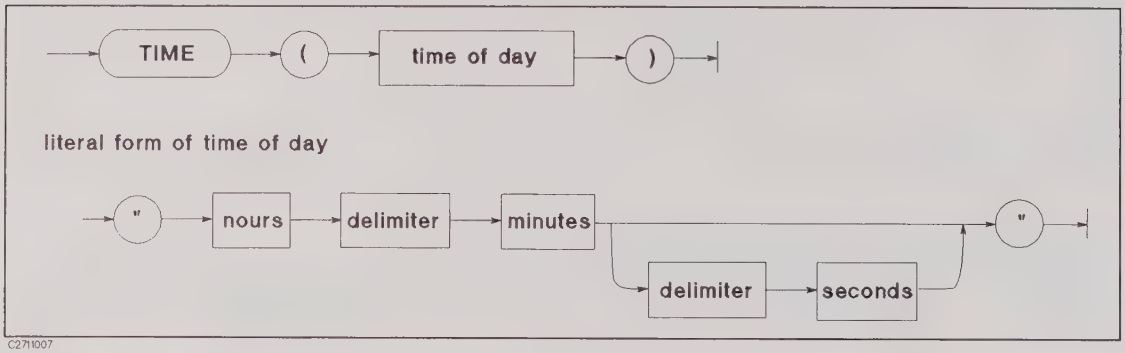
- Semantics

  The volatile clock is set to 2.08662912E+11 (midnight March 1, 1900) at power-on. If there is a battery-backed (non-volatile) clock, then the volatile clock is set to its value at power-up. If the computer is linked to an SRM system (and has no battery-backed clock), then the volatile clock is set to the SRM clock value when the SRM and DCOMM binaries are loaded. The clock values represent Julian time, expressed in seconds.

TIME

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command converts data formatted as time of day (HH:MM:SS), into the number of seconds past midnight.



Item	Description	Range
time of day	string expression representing the time in 24 hour format	(set drawing)
hours	literal	0 to 23
minutes	literal	0 to 59
seconds	literal; default = 0	0 to 59.99
delimiter	literal; single character	(see text)

- Example Commands

```
Seconds=TIME(T$)
SET TIME TIME("8:37:20")
ON TIME TIME("12:10") GOSUB Lunch
```

- Semantics

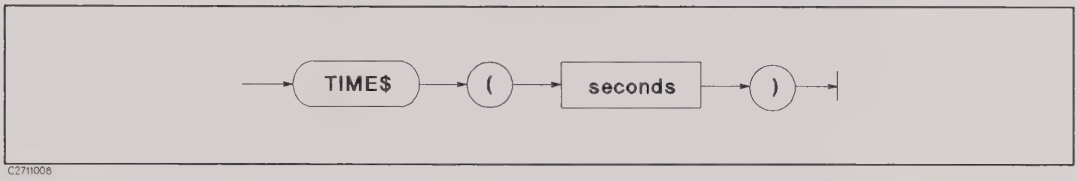
  This command returns a positive integer, in the range 0 to 86399, equivalent to the number of seconds past midnight.

  While any number of non-numeric characters may be used as a delimiter, a single colon is recommended. Leading blanks and non-numeric characters are ignored.

TIME$

Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

This command converts the number of seconds past midnight into a string representing the time of day (HH:MM:SS).



Item	Description	Range
seconds	numeric expression, truncated to the nearest second; seconds past midnight	0 to 86399

- Example Commands

```
DISP "The time is:  ";TIME$(TIMEDATE)
PRINT TIME$(45296)
```

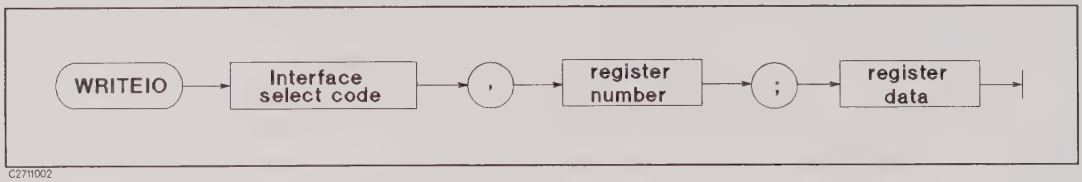
- Semantics

  TIME$ takes the time in seconds and returns the time of day in the form HH:MM:SS, where HH represents hours, MM represents minutes, and SS represents seconds. A module 86400 is performed on the parameter before it is formatted as a time of day.

WRITEIO

Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

This statement writes register data in decimal notation to a specified EXECUTE command parameter register or to a specified I/O port.



Item	Description	Range
select code	numeric expression	8: EXECUTE register 15: I/O port
register number	numeric expression	0 to 800 (Select code 8) 0: I/O port
register data	numeric expression	−2147483648 to +2147483647 0 to 255: I/O port

- Example Commands

```
WRITEIO 15,0;12

100  WRITEIO 8,0; 100E6
110  WRITEIO 8,1; 200E6
120  EXECUTE "ANARANG"
```

- Semantics
  - How to write data to the I/O port:

    When writing data to an I/O port, use `15,0` as the select code and the register number that corresponds with the register. The range of register data for the I/O port is 0 through 255.

  - How to write HP-IB command parameters when the `EXECUTE` command is used:

    The `EXECUTE` command uses the data stored in a register (select code 8) as a parameter. To store this parameter, the `WRITEIO` command must be executed before the `EXECUTE` command. The `WRITEIO` command stores one parameter in one register like the `READIO` command. For an HP-IB command that requires multiple parameters, use as many `WRITEIO` commands as the number of parameters. For more information on the `EXECUTE` command, see the "EXECUTE" command.

The HP-HIL Keyboard

The HP-HIL keyboard keys are arranged into the following functional groups:

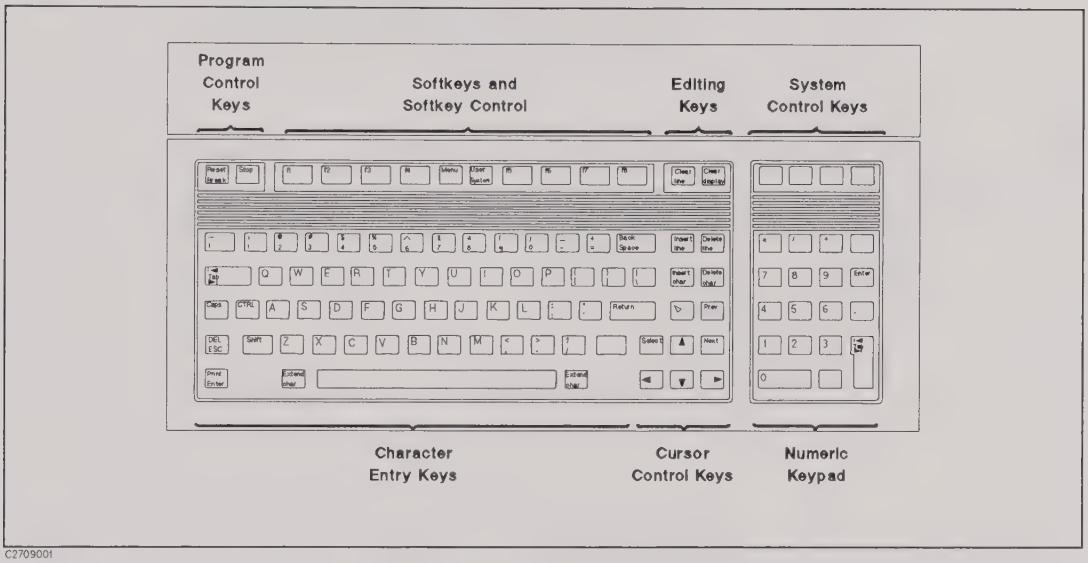
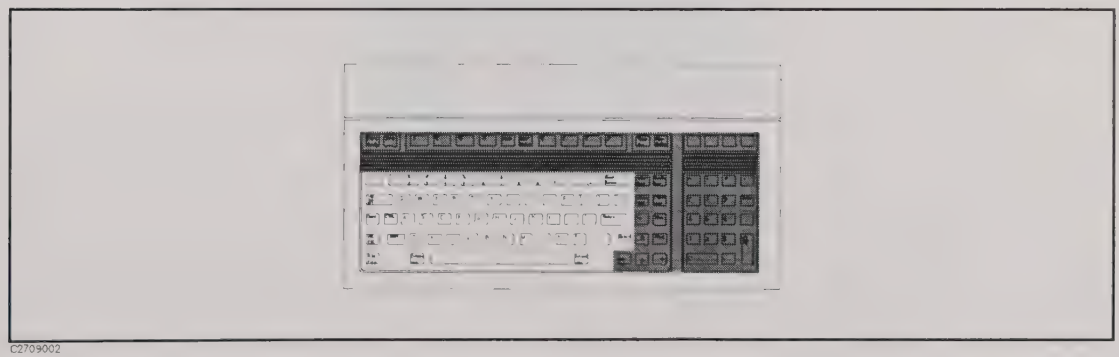


Figure C-1. HIL-Keyboard

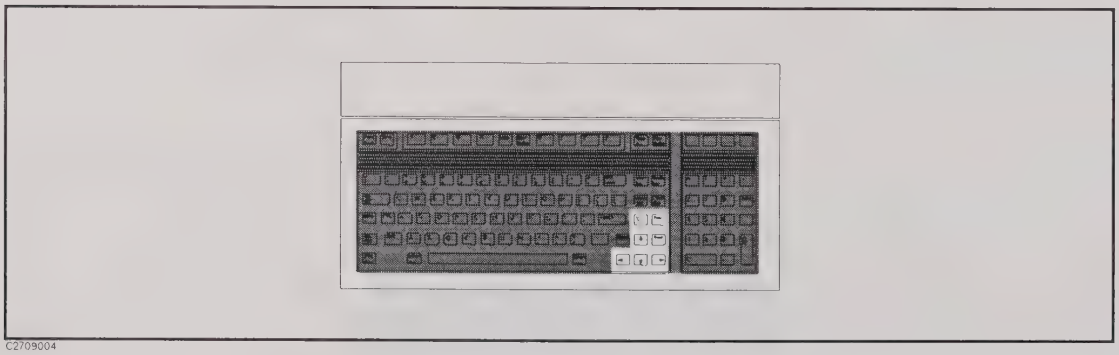
Character Entry Keys



The character entry keys are arranged in the familiar QWERTY typewriter layout, but with additional features.

Caps	Sets the unshifted keyboard to either upper-case (which is the default after power ON) or lower-case (normal typewriter operation).
Shift	You can enter standard upper-case and lower-case letters, using the Shift key to access the alternate case.
Return	Has three functions: ■ When a running program prompts you for data, respond by typing in the requested data and then press Return. This signals the program that you have provided the data and that it can resume execution. ■ When typing in program source code, the Return key is used to store each line of program code. ■ After typing in a command, the Return key causes the command to be executed.
Enter	Is the same as pressing the Return key.
Print	(Shift-Enter) performs no function.
CTRL	In the EDIT mode, CTRL allows you to control the editor in the same as using the cursor-control, display-control, and editing keys. For more detail, see "Using CTRL Key in Edit Mode".
Select	Performs no function.
Back space	Erases the character to the left of the cursor and moves the cursor to the erased character's position on the line.
Tab	Performs no function.

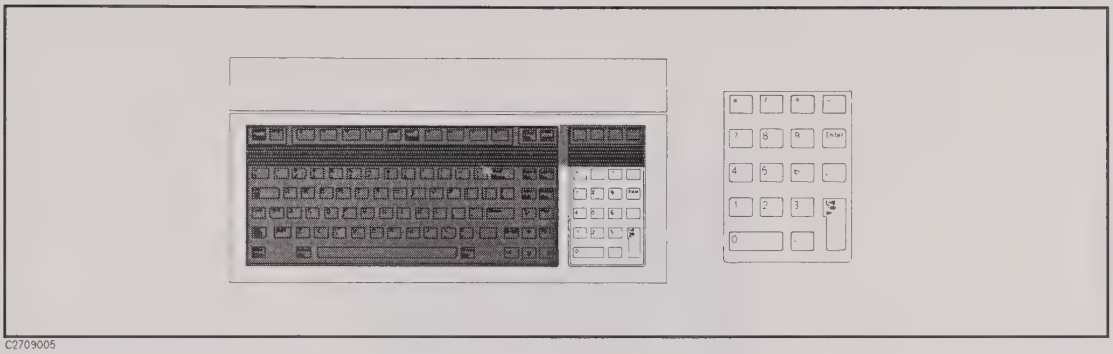
Cursor-Control and Display-Control Keys



C2709004

▲ ▼	Allow you to scroll lines up and down in the print display area. Shifted, these keys cause the display to scroll toward the top or bottom of the display.
▶ ◀	Allow you to move horizontally along a line. Shifted, these keys allow you to "jump" to the left and right limits of the current line.
Next Prev	Cause the display to scroll up or down in one-half page increments.
▼	Performs no function.

Numeric Keypad



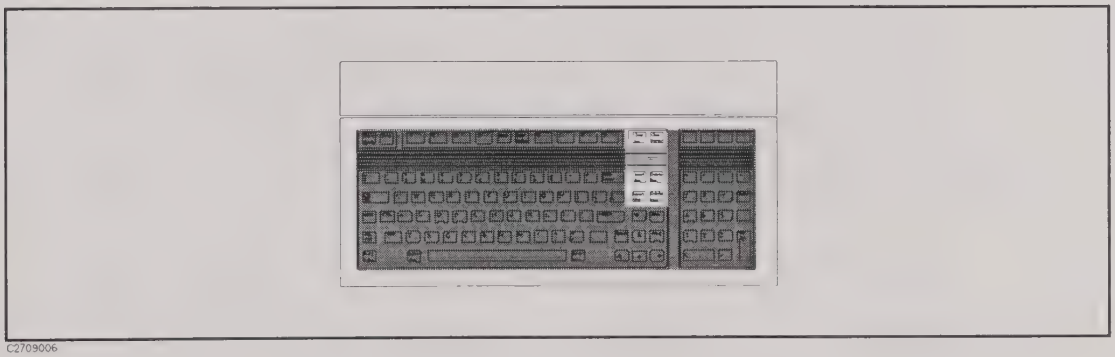
C2709005

The numerical keypad provides a convenient way to enter numbers and perform arithmetic operations. Just type in the arithmetic expression you want to evaluate, then press [Enter]. The result is displayed in the lower-left corner of the screen.

[Enter] — Performs the same function as the [Return] key. The numerical keypad serves the same function as the numerical keypad on the front panel of the analyzer.

[Tab] — Performs no function.

Editing Keys



C2709006

[Insert line] — Inserts a new line above the cursor's current position (edit mode only).

[Delete line] — Deletes the line containing the cursor (edit mode only).

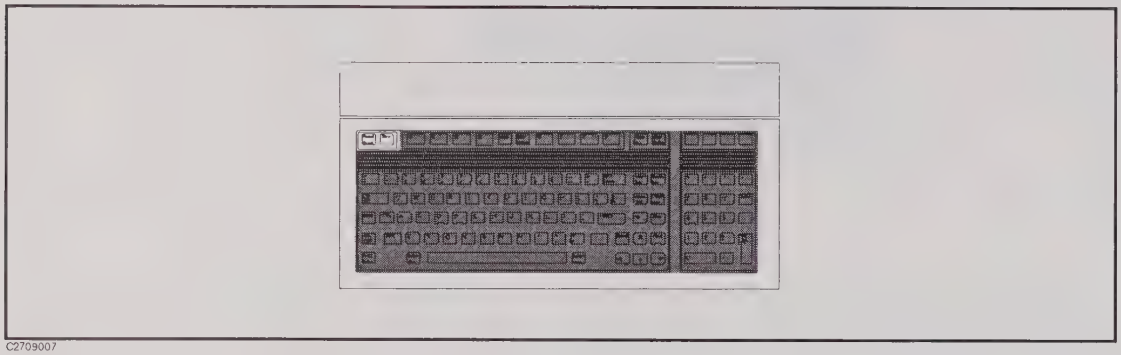
[Insert char] — Performs no function. The HP Instrument BASIC is always in the insert mode. The characters you type are always inserted to the left of the cursor.

[Delete char] — Deletes the character at the cursor's position.

[Clear line] — Clears from the current cursor position to the end of the line.

Clear display Clears the entire alpha screen. In EDIT mode, this exits the EDIT mode.

Program Control Keys



C2709007

The following keys allow you to control execution of the program stored in the analyzer's memory.

Stop Unshifted-Stop pauses program execution after the current line. Pressing `Continue` in the System menu resumes program execution from the point where it paused.

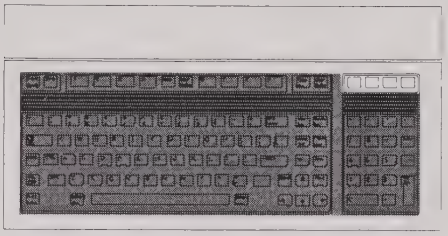
Shift-Stop stops program execution after the current line. To restart the program, press `Run` in the System menu.

When in the editor mode, Stop exits the edit mode.

Break Pauses program execution when the computer is performing or trying to perform an I/O operation. Press Break instead of unshifted-Stop when the computer is hung up during an I/O operation, because unshifted-Stop works only after the computer finishes the current program line.

Shift-Break resets program execution immediately without erasing the program from memory (**BASIC RESET**).

System Control Keys



C2709008

The unlabeled keys above the numeric keypad control various system functions related to the program.

To easily identify the keys in the following description, we'll use the following convention:

- [Key-1] — Above the [*] key.
- [Key-2] — Above the [/] key.
- [Key-3] — Above the [+] key.
- [Key-4] — Above the [−] key.

[Key-1] (Recall) — Unshifted-[Key-1] (Recall) recalls the last line the you entered, executed, or deleted. Several previous lines can be recalled this way. Recall is particularly handy to use when you mistype a line. Instead of retyping the entire line, you can recall it, edit it using the editing keys, and enter or execute it again.

[Shift]-[Key 1] moves forward through the recall stack.

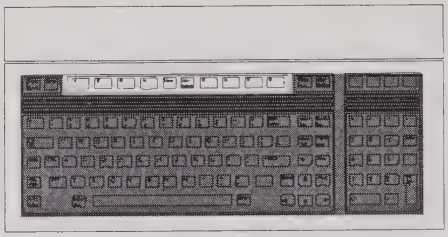
[Key-2] (Run) — Starts a program running from the beginning.

[Key-3] (Continue) — Resumes program execution from the point where it paused.

[Key-4] (IBASIC) — Allows you to type BASIC commands on Keyboard Input Line. If Display Allocation is ALL INSTRUMENT, pressing this key changes the Display Allocation to BASIC STATUS.

[Shift]-[Key-4] changes Display Allocation to ALL INSTRUMENT.

Softkeys and Softkey Control



C2709009

There are eight softkeys (labeled f1 through f8 and two keys that control the definition of the softkeys (Menu and User System)). The softkey labels are indicated on the right of the analyzer's screen.

Softkey Control Keys

Pressing the following:

Menu — Leads to the Edit menu, which controls programs and the editor.

User System — (Unshifted-User System) leads to the BASIC menu from which to control a BASIC program. This menu is the same menu displayed when pressing SYSTEM IBASIC from the front panel.

In the edit mode, pressing User System leads to the Edit System menu, which provides softkeys to conveniently enter BASIC commands.

Shift-User System (User) leads to the ON KEY LABEL menu, which are user defined softkeys in a BASIC program. (For information on getting to this menu through the HP Instrument BASIC, see "On Key Label Function" in Chapter 8.)

Softkeys

Figure C-2 shows the softkey menus accessed from the Menu and User System keys. Pressing a softkey performs the command labeled or produces a sequence of characters on the keyboard input line (or on the "current line" in the EDIT mode).

Pressing the softkeys on the front panel of the analyzer performs the same functions as pressing the f1 through f8 function keys.

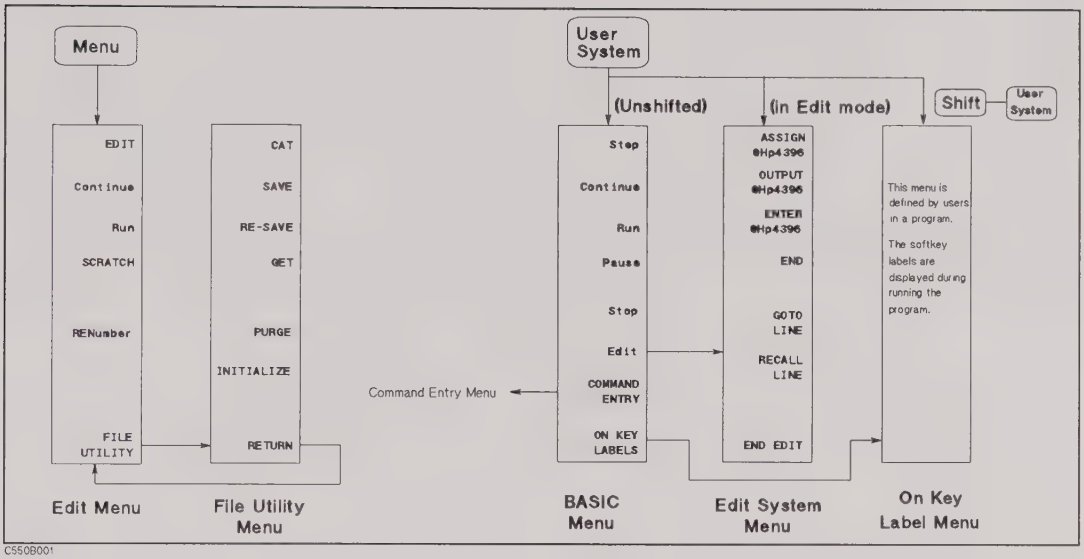


Figure C-2. Softkey Menus Accessed from (Menu) and (User System) Key

Softkeys Accessed from (Menu) Key

Edit Menu

Pressing the following:

`EDIT`	Produces the command "`EDIT`" on the keyboard input line. After `EDIT` is entered, pressing (Return) enters the edit mode.
`Continue`	Resumes program execution from the point where it paused.
`Run`	Immediately executes a program.
`SCRATCH`	Produces the command "`SCRATCH`". The `SCRATCH` erases the program in memory. After `SCRATCH` is entered, pressing (Return) executes the command.
`RENumber`	Produces the characters "`REN`". `REN` renumbers all of the program lines currently in memory.
`FILE UTILITY`	Leads to the File Utility softkey menu to access the disk.

File Utility Menu

Pressing the following:

`CAT`	Produces the command "`CAT`". `CAT` lists the contents of a mass storage directory.
`SAVE`	Produces the command "`SAVE""`". `SAVE` creates an ASCII file and copies program lines as strings into that file.
`RE-SAVE`	Produces the command "`RE-SAVE""`". `RE-SAVE` creates a specified ASCII file if it does not exist; otherwise, it rewrites a specified ASCII file by copying program lines as strings into that file.
`GET`	Produces the command "`GET""`". `GET` reads the specified ASCII file and attempts to store the strings into memory as program lines.

PURGE	Produces the command "PURGE"". PURGE deletes a file or directory from the directory of a mass storage media.
INITIALIZE	Produces the command "INITIALIZE". INITIALIZE prepares mass storage media for use by the computer. When INITIALIZE is executed, any data on the media is lost.
RETURN	Goes back to Edit menu.

Softkeys Accessed form [User System] Key

[User System] key allows you to access three different softkey flows dependent on conditions as follows:

- Pressing unshifted-[User System] accesses the Program Control menu
- In editor mode, pressing unshifted-[User System] accesses the Edit System menu
- Pressing [Shift]-[User System] accesses the On Key Label menu.

The menus listed above are described in "Instrument BASIC Menu" in Chapter 8 of the *Function Reference.*

Using [CTRL] Key in Edit Mode

In the edit mode, pressing [CTRL], holding it down and pressing another key, allows you to control the editor in the same way as pressing control keys such as [▲], [▼], [Insert line], etc.

If you press ...	It performs ...
[CTRL]-[a]	Moves the cursor to beginning of line, (the same function as [Shift]-[◀]).
[CTRL]-[b]	Moves cursor backward one character, (the same function as [◀]).
[CTRL]-[d]	Deletes a character, (the same function as [Delete char]).
[CTRL]-[e]	Moves the cursor to end of the line, (the same function as [Shift]-[▶]).
[CTRL]-[f]	Moves cursor forward character along a line, (the same function as [▶]).
[CTRL]-[g]	Allows you to move the cursor to any line number or label, after press [CTRL]-[g], type a line number or label name and press [Return], the cursor moves to the specified line, (the same function as GOTO LINE).
[CTRL]-[h]	Deletes backward one character, (the same function as [Back Space]).
[CTRL]-[j]	Performs the same function as [Return].
[CTRL]-[k]	Deletes a line from the cursor's current position to the end of the line.
[CTRL]-[m]	Performs the same function as [Return].
[CTRL]-[n]	Moves the cursor to the next line, (the same function as [▼]).
[CTRL]-[o]	Inserts a new line above the cursor's current position, (the same function as [Insert line]).
[CTRL]-[p]	Moves the cursor to the previous line, (the same function as [▲]).

D

Softkeys Used for HP Instrument BASIC Operation

The following softkeys are available only when the HP Instrument BASIC option (option 1C2) is equipped to the analyzer:

(System) `IBASIC` controls HP Instrument BASIC.

`MEMORY PARTITION` changes size of memory areas for HP Instrument BASIC and the RAM disk.

(Display) `DISPLAY ALLOCATION` allocates the BASIC screen area on the display.

System

IBASIC

Displays the following softkeys to control HP Instrument BASIC (IBASIC):

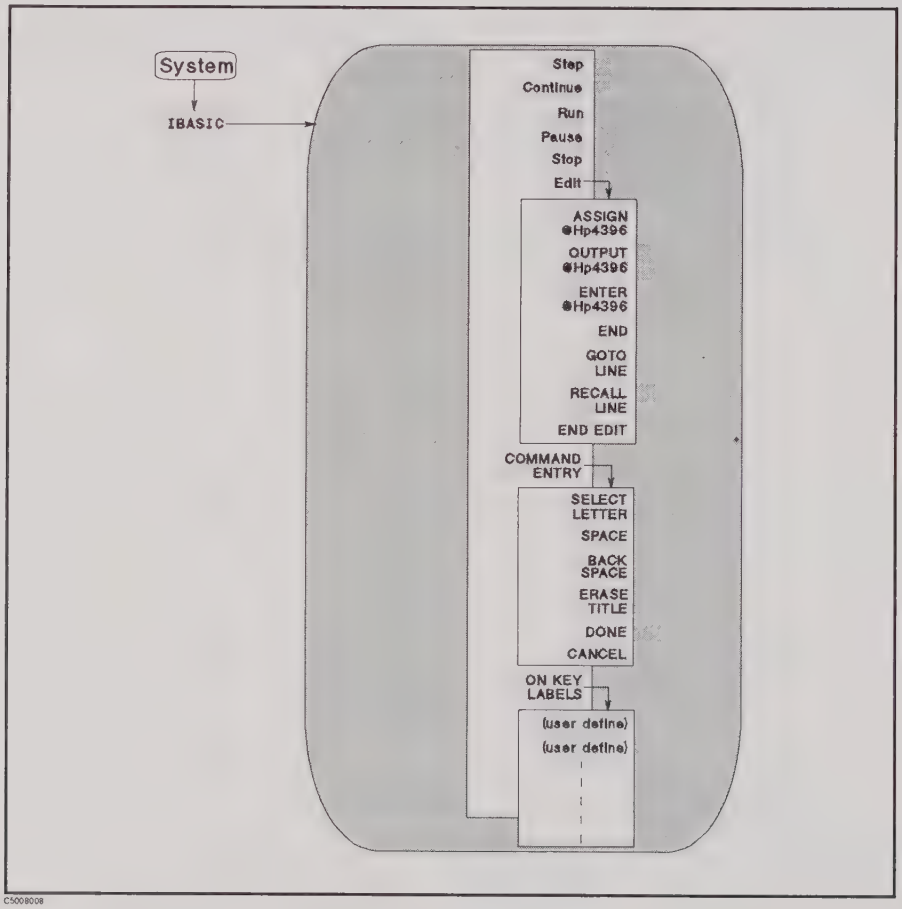


Figure D-1. IBASIC Menu

`Step`	Allows you to execute one program line at a time. This is particularly useful for debugging.
`Continue`	Resumes program execution from the point where it paused.
`Run`	Starts a program from its beginning.
`Pause`	Pauses program execution after the current program line is executed.
`Stop`	Stops program execution after the current line. To restart the program, press `Run` .
`Edit`	Enters into the EDIT mode.

`ASSIGN @Hp4396`	Produces the command "`ASSIGN @Hp4396 TO 800`" at the cursor's current position.
`OUTPUT @Hp4396`	Produces the command "`OUTPUT @Hp4396;""`" at the cursor's current position.
`ENTER @Hp4396`	Produces the command "`ENTER @Hp4396;`" at the cursor's current position.
`END`	Produces the command "`END`".
`GOTO LINE`	Allows you to move the cursor to any line number or to a label. After pressing `GOTO LINE`, type a line number or a label and then press (Return). The cursor moves to the specified line or label.
`RECALL LINE`	Recalls the last deleted line.
`END EDIT`	Exits the edit mode.
`COMMAND ENTRY`	Leads to the Command entry menu, which allows you to execute the HP Instrument BASIC commands from the front panel keys.
`SELECT LETTER`	Selects the character pointed to by "↑".
`SPACE`	Inserts a space.
`BACK SPACE`	Deletes the last character entered.
`ERASE TITLE`	Deletes all characters entered.
`DONE`	Terminates command entry, and executes the command you entered.
`CANCEL`	Cancels command entry and returns to the BASIC menu.
`ON KEY LABELS`	Leads to a softkey menu defined during program execution, if the softkey menu has been defined.

MEMORY PARTITION

Changes size of memory areas for HP Instrument BASIC and the RAM disk memory.

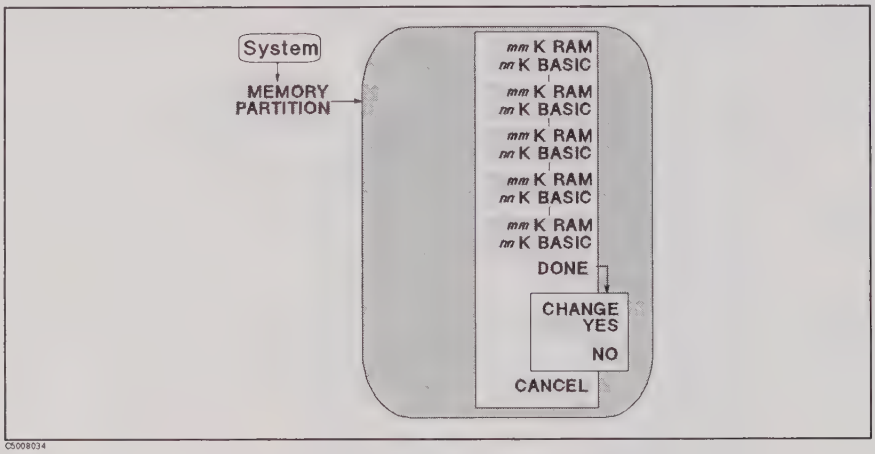


Figure D-2. Memory Partition Menu

`mm K RAM nn K BASIC`	Selects memory partition so that *mm* Kbyte is for RAM disk memory and *nn* Kbyte is for HP Instrument BASIC.
`DONE`	Terminates selecting memory partition and displays the following softkey labels.
`CHANGE YES`	Executes to change memory partition to one selected.
`NO`	Cancels to change memory partition and return to the previous softkey menu.

Caution When the memory partition is reconfigured, the analyzer goes to the initial settings. That is, the RAM disk memory is initialized and all the data saved in the RAM disk memory is destroyed, and the program on the BASIC editor is destroyed.

Display

DISPLAY ALLOCATION

Displays the following menu to allocate the BASIC screen area on the display.

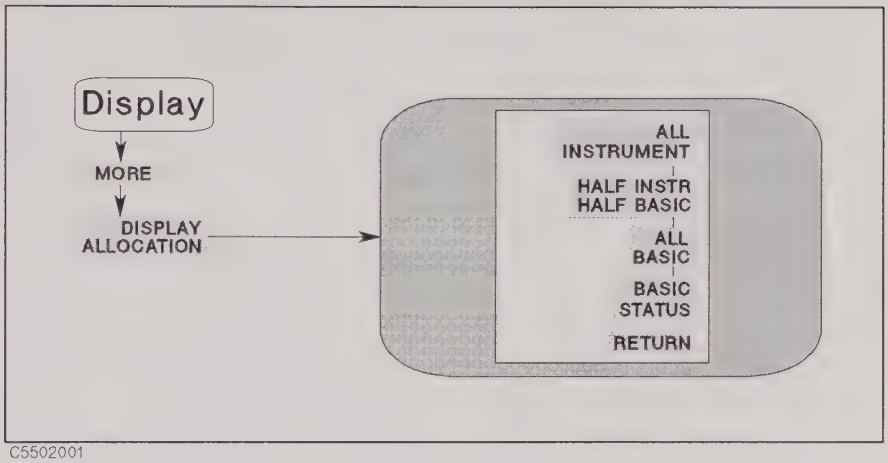


Figure D-3. Display Allocation Menu

ALL INSTRUMENT	Selects a full screen single screen or two half-screen graticules.
HALF INSTR HALF BASIC	Selects two half-screens, one graticule display above the HP Instrument BASIC display.
ALL BASIC	Selects a full screen single HP Instrument BASIC display.
BASIC STATUS	Selects a full screen graticule and three status lines for HP Instrument BASIC under the graticule.

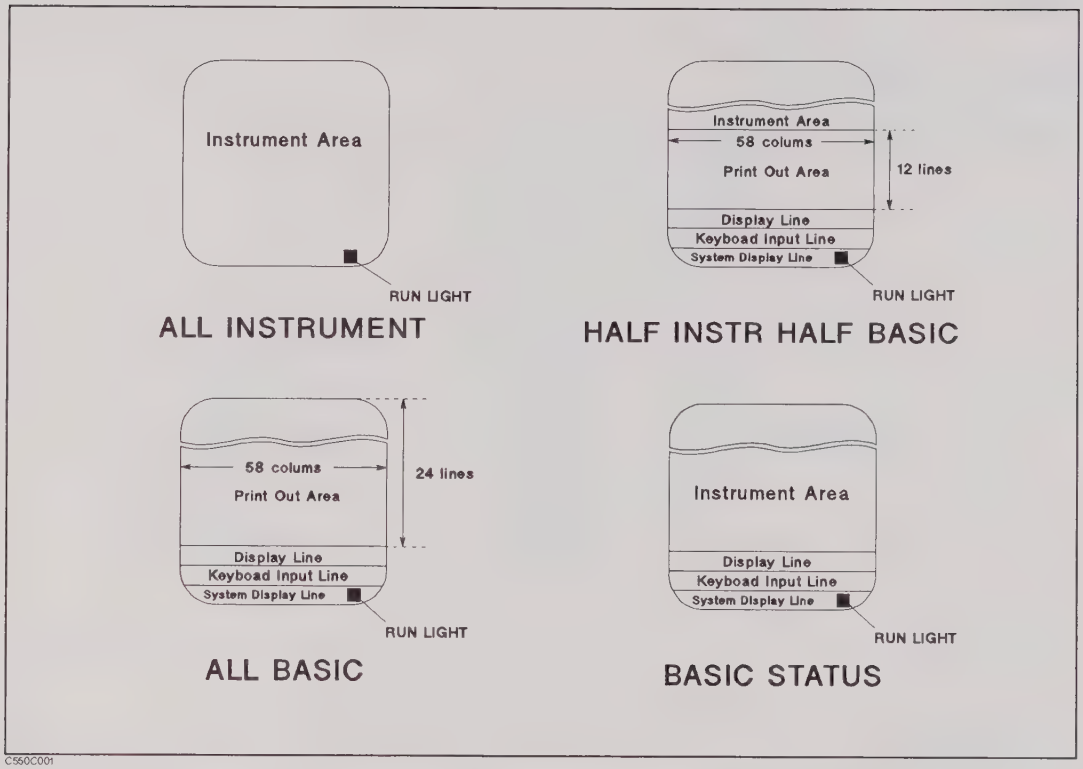


Figure D-4. Display Allocation

The following table lists the number of lines and columns in the BASIC print area for each display allocation. It also shows the keyboard input line status for each allocation. When the keyboard input line is available, you can execute BASIC commands from the keyboard.

Display Allocation	BASIC Print Area		Keyboard Input Line
	Columns	Lines	
All Instrument	0	0	not available
Half Instrument Half BASIC	58	12	available
ALL BASIC	58	24	available
BASIC Status	0	0	available

The analyzer can be connected to an external monitor (option 00M only). For information on the recommended monitor, see Chapter 9 of the *Function Reference*.

Run Light Indications

␣ (blank) Program stopped; can execute commands; CONTINUE not allowed.

\- Program paused; can execute commands; CONTINUE is allowed.

? BASIC program waiting for input from keyboard; cannot execute commands.

* This indication has two possible meanings:

- Program running; CANNOT execute commands. CONTINUE not allowed.
- System executing commanded entered from keyboard; CANNOT enter commands.

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Hewlett-Packard S.A.
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Operations
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Greece
Tel: (30)682 88 11
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May, 1990

BENELUX & SCANDINAVIA

Hewlett-Packard S.A.
Uilenstede 475
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NL-1183 AG **AMSTELVEEN**
The Netherlands
Tel: (31)20/43 77 71
Telex: 18 919 hpner nl

SOUTH & EAST EUROPE, AFRICA

Hewlett-Packard S.A.
7 rue du Bois-du-Lan
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Switzerland
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Cable: HEWPACKSA Geneva

FRANCE

Hewlett-Packard France
Parc d'activites du Bois Briard
2, avenue du Lac
91040 **EVRY** Cedex
Tel: 1 6/077 83 83
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GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Hewlett-Packard-Strasse
Postfach 1641
D-6380 **BAD HOMBURG**
West Germany
Tel: 06172/400-0
Telex: 410 844 hpbhg

ITALY

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
1-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: 02/92 36-91
Telex: 334632

UNITED KINGDOM

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 734/78/ 47 74
Telex: 847178

EASTERN USA

Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
TEL: (301)670-4300

MIDWESTERN USA

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 6008
Tel: (312)255-9800

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Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
ATLANTA, GA 30348
Tel: (404)955-1500

WESTERN USA

Hewlett-Packard Co.
5161 Lankershim Blvd.
P.O. Box 3919
NO. HOLLYWOOD, CA 91609
Tel: (818)506-3700

OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
Tel: (415)857-1501
Telex: 034-8300
Cable: HEWPACK

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